TRANSACTIONS

OF THE

Odontological Society of Great Britain.

VOL. XV.—NEW SERIES.

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THOMAS A. ROGERS, M.R.C.S. AND L.D.S., ENG.

From a photograph by MR. BARRAUD.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

November 6th, 1882.

S. LEE RYMER, Esq., President, in the Chair.

On taking his seat, the President addressed a few words of welcome to the members assembled, and congratulated them on the appearance of improved health which most of them presented as the result of their recent vacations.

Since the last meeting of the Society in June, some events had occurred which he felt ought not to be allowed to pass without some official notice from himself. In the first place, there was the Annual General Meeting of the British Dental Association at Liverpool. He was sure that all who had been present would agree with him that it was a most interesting meeting, and highly successful, both from a scientific and social point of view. He might further call attention to the fact that the success of that meeting was largely due to the interest taken in it by the members of the Odontological Society, for of those present at Liverpool, nearly half were members of that body, including no less than six past presidents, and nearly all its present executive officers.

The other events to which he had to refer were of a very different and mournful character. Since the close of their last session, the Society had lost by death two well-known honorary members. One was Mr. J. T. Clover, whose services in connection with the administration of anæsthetics had made his name known throughout the world. He had been for ten years an honorary member of their Society, and at his death its members lost a valued friend.

The death of Mr. Alfred Canton had occurred quite recently. He, also, was a man whose high professional attainments and kindly social bearing had endeared him to a large circle of friends. He had always taken a great interest in dental reform, and was one of those who had signed the first memorial presented to the College of Surgeons in 1856, praying for the establishment of the dental diploma.

He believed that he should only be expressing the feelings of the members generally, in suggesting that the Secretary should be requested to convey in the name of the Society, an expression of their sympathy to the relatives of the late Mr. Clover and of Mr. Alfred Canton.

This was unanimously agreed to.

The Minutes of the last meeting having been read and confirmed—

The PRESIDENT announced that the following books had been presented to the Society's library:—

Mr. Stocken's "Elements of Dental Materia Medica and Therapeutics," 3rd Edition; presented by the author.

"The Transactions of the New York Odontological Society," and the "Transactions of the Smithsonian Society, 1881–82."

The following gentlemen signed the Obligation Book, and were formally admitted to membership by the President:—

MESSRS. E. A. BEVERS, C. D. DAVIS, and HARRY ROSE.

The PRESIDENT announced that the following candidates had been duly nominated, and would be balloted for at a subsequent meeting, viz.:—

MESSRS. BENTLEY, J. BONNELL, 95, Cornwall Gardens, S.W.; and JAMES GRANT, St. Heliers, Jersey.

The following candidates were then balloted for and elected Members of the Society, viz.:—

MR. THOS. READ, L.D.S., of Holles Street, Cavendish Square, as Resident Member; and—

MR. ALFRED JOHN BAKER, of Walcott Buildings, Bath, as non-Resident Member.

Mr. Alfred Coleman made the following casual communications:—

He first related the case of a little boy, who suffered acutely from tooth-ache, followed by two severe attacks of epileptiform convulsions. The tooth causing the pain was removed, and the fits at once ceased. The case might possibly be an example of the influence of dental irritation in producing disturbance of the nervous system; but as the child had also been subjected to medical treatment, it was probable that that might have had something to do with his recovery, and that the extraction of the tooth and the cessation of the fits were not as directly cause and effect as they appeared to be.

He next mentioned the case of a gentleman, an eminent physician in his day, but now in his 89th year, who two years since erupted a wisdom tooth, which having taken an outward direction, caused some discomfort by pressing on the cheek. This patient had also some remarkable exostoses on the lower jaw, the most extensive, he (Mr. Coleman) had ever seen, and models of which he had exhibited before the Society. These had, however, certainly diminished in size of late; one in particular, which had at one time a projection of three quarters of an inch, had diminished one-eight inch at least. A knowledge of this might possibly be useful to other members, if they should be called upon to give a prognosis with regard to similar growths in elderly subjects.

The last case he had to mention was that of a lady, who came to him that morning to have a tooth pivotted. The tooth had a yellow appearance, as if necrosed, and he fully expected when he removed the crown to find a decomposed pulp. But instead of this he found no pulp at all, the cavity being completely filled with secondary dentine. He then drilled cautiously into the root, fully expecting to come upon some remains of the pulp; but he drilled almost to the extremity, without meeting with any cavity, the canal being also completely filled with secondary dentine. He considered that this state of things promised well for the future of the operation.

Mr. Redman said he had a somewhat similar specimen to show, viz., an upper molar with almost complete calcification of the pulp. The lady to whom it had belonged had suffered for a number of years from most severe attacks of pain, which she referred to this tooth, and she had consulted several dentists with the view of getting rid of it; but the tooth appeared so thoroughly sound that they one and all refused to extract it. At last the patient came to him (Mr. Redman), and for some time he could find nothing the matter with it; but at last on directing a very strong light on to the teeth, he noticed that whilst the neighbouring teeth showed some amount of translucency, this one was quite opaque. This led him to diagnose calcification of the pulp. He therefore proceeded to extract it, and on afterwards splitting it, found that his diagnosis had been perfectly correct.

He showed also an upper molar with the roots very much spread, which he had extracted from the mouth of a gentleman about fifty years of age; of course the operation was not a particularly easy one. He showed also an unusually long bicuspid which he had removed from the mouth of a young lady eighteen years of age.

Mr. Charles Tomes said that in the course of a paper which he had the honour of reading at the Meeting of the British Dental Association at Liverpool, on "The Influence of Septic Organisms in the production of Dental Diseases," he asked the question—Do we ever get inflammation about the root of a dead tooth which is not of septic origin? The question was not an easy one to decide, but it did sometimes happen that a valuable experiment was performed for us which afforded some aid towards a solution; *i.e.*, when the pulp of an absolutely intact front tooth was killed by a blow. No doubt most of those present had met with such cases. The tooth was tender for a time, and sometimes an abscess formed, sometimes not. If this danger was escaped, the tooth might settle down and remain quiet for years. He had lately had an opportunity of examining two such teeth which had been killed by an accident four years ago. There was no actual

open abscess in connection with either of them, but they were tender, and there was clear evidence of inflammation about the apices of the roots in the form of localized swelling and tenderness. On opening the pulp cavity the remains of the pulp were found in the form of a very moist, whitish, bulky mass, nearly filling the pulp cavity, but not in the least offensive, nor could any bacteria or micrococci be found in it. This case seemed to indicate the possibility of the existence of inflammation about the roots of dead teeth which was not of septic origin. But it was only a single instance, and not enough by itself to answer the question; and he would therefore beg any of those present who might happen to meet with such cases, which were not seen every day, carefully to note the state of the pulp immediately after extraction.

The PRESIDENT then called upon Dr. Alfred Carpenter to read the paper of the evening.

A Consideration of some of the Causes which give rise to Dental Decay.

By Alfred Carpenter, M.D.

Gentlemen,—When I consented, at the request of your President, to address you this session, I somewhat underrated the importance of the work I undertook to perform. I ought to have hesitated before agreeing to do a duty which involved something more than the expression of my own views, upon points regarding which I might feel myself competent to advise or instruct you. But having accepted the duty, it would scarcely be in accord with my ideas of an Englishman's character if I did not attempt to do the work I had undertaken to perform. I propose, therefore, to follow up the line of thought which is ever in my mind, upon the causation of disease, and to consider that subject in relation to the teeth, on the principle that prevention is, in a large proportion of cases, better and easier than cure: and also that there is a field for observations and practice here, as well as everywhere else in the domain of medicine and surgery. This will especially apply to caries and several other maladies which naturally come to the notice of the

surgeon-dentist in the practice of his profession. Are diseases of the teeth more common in our time than they were in the early days of civilization. Has the artificial life in which we live now, seriously damaged the dental organs, and has it promoted their earlier decay than was the case in the time of our forefathers?

To solve this question we must go to ancient history.

Diseases of the teeth were not unknown to those nations regarding whom we have early records. We gather from Herodotus that there were dentists in Egypt in the time of the Pharaohs, and it is said that Belzoni discovered artificial teeth in the sarcophagi of the Egyptians. Erasistratus, Hippocrates, Heraclides of Tarentum, and other Grecian writers, speak of diseases of the teeth as if they were not uncommon in their days. Whilst Celsus describes the dentist's duty very accurately, and gives us a clear insight into the system in operation among the Romans in his time. Galen also is particular in his descriptions of dental diseases. Dental caries was therefore common enough among the ancients, and from all that we can learn, these diseases are not a new class, and do not therefore show a new departure in pathology. Yet there is sufficient evidence to tell us that luxury, indolence, and vice tend very much to promote the development of such diseases, and

the foundation for those conditions which produce decay of all kinds in the dental organs, as well as elsewhere. This evidence is given by the state in which the teeth are generally found in the mummies of ancient Egypt and in the jaws of those skeletons which have been preserved to us from the early days of Christian sepulture.

Disease in the teeth was the exception in those times, whilst in our day it is the rule. It may be true that those teeth which decay had touched during the lifetime of their possessors had been unable to stand against continuing decay after death, and that sound teeth alone remain in their original form to our time. This is not, however, all true, for decayed teeth are sometimes found. Teeth giving evidence of caries which had existed during the lifetime of their owners do continue to remain *in situ*. There would be also vacancies in the jaw-bone indicating the position of the absent teeth if such decay had taken place. According to the accounts of some travellers, the majority of Egyptian mummies which are unrolled to-day exhibit perfect sets of teeth, and the majority of those jaws which have been examined in some of the catacombs in which the early Christians were buried, are perfect; whilst it is the exception now to find a middle-aged person who has not lost many of his dental appendages.

Before proceeding to discuss the principle upon

which decay may depend, I will run over a list of the conditions which, in my opinion, may be first causes for the foundation of change, and for the continuance of active decay. These causes are very various, and each may be distinct in itself or conjoined with one or more in the class, and thus a kind of hybrid may be produced which at present prevents a good classification.

In the first place, there cannot be any doubt as to the effect of inherited tendencies,—some state which has been engrafted into the constitution by the acts, the habits, or the vicious conduct of preceding generations. This state may give rise to irregular developments, as to shape and size, or the order in which the teeth are set in the jaw-bones introducing a race of beings in which the new condition becomes all but natural. Or it may show itself in those forms of constitutional disease the presence of which does not appear to have arisen in the earlier days of the world, as far as we can learn from ancient history, for syphilitic conditions which are common now, find no representatives in the Egyptian tombs. These conditions descending in later times from grandfather to grandson, or even from ancestors more distant still, show the taint, in the unnatural form and early decay of both the temporary and permanent sets of teeth. These syphilitic states produce their first causes by setting up alterations in the proto-

plasm or primary germ of the new life ; for when the tooth is developed, as I shall show later on, conditions and consequences arise for which the parent must be responsible. A similar condition is met with to some extent, though not with so determined a result, in those persons who have had gouty ancestors. Children who have inherited a gouty constitution suffer, to some extent, according as to whether that gouty state was also inherited by the parent himself, or purchased by his own acts. In some cases it falls with double vengeance upon the child, for the parent has not only inherited the condition, but he has added to it by his own love of vicious feeding and strong drink. The young man who makes a god of his belly, and thinks more of his eating and drinking than of his children's welfare, or of his own future state, may procreate a generation of persons who may suffer much from dental as well as from other defects. The pains which the children innocently endure in this world are, to my mind, the punishments which will have to be borne by the father in the next. They assist to make up the measure of that future which we are sometimes taught to regard as the result of the wrath of our Maker for our own sins, whilst in reality it is simply the sequence of our own acts and deeds. This sequence arises in consequence of the immutable laws which the Creator has given

to matter, and is not as the result of the anger of a revengeful Deity.

Besides syphilis and gout, both of which have a direct action upon cutaneous surfaces, and, as I wish to show, a special action upon the teeth, we have constitutional diseases affecting development of the other parts of the primordial utricle, or first layers of the original protoplasm. This shows itself in the defective nerve power, and in the inefficient nutritive force which promotes the growth of the homunculus. Then there are all the consequences of accidental damage or injury to the fœtus, or to the young child, which may produce immediate effects, or show themselves later on in life,—causes which have been in temporary operation only, or which may have been continuous,—causes which have produced immediate results, or which have only developed their natural sequences years after such causes have ceased to be,—causes connected with the simple wear and tear of the organ itself, and which have been induced by a wrong kind of food, by defective muscular action, one muscle acting stronger than its fellow, or by an improper action on the part of the nurse or guardian, or perhaps of the family doctor in prescribing dangerous remedies at the wrong time, and in wrong doses—or causes which have been induced by the cupidity of man in adulterating food with articles which were not intended for the

human teeth to grind, or the human stomach to digest. All these causes and conditions operate to provide work for the dentist, and all are more or less preventible in future generations, if not in our own time.

I need not detain you by a discourse upon the chemical constituents of the teeth. The nature of those constituents, as well as of bone in general, are well known to you. I will simply recall to your mind the fact that phosphate of lime is the principal inorganic matter in the substance of the teeth, but that if all the mineral matter is removed from a tooth, there is a skeleton of organic matter remaining, which is equal in volume to that of the tooth itself. But that whilst dentine contains some 28 parts per cent. of organic matter, it falls to less than 3 per cent. in the enamel. I may also remind you that the *crusta petrosa* is closely allied to, if not identical with, true bone. You are already fully acquainted with the course which is taken in the development of the teeth—the first step in that development being a visible thickening (in the sixth week of fœtal life) of the epithelium which covers the free border of the jaw; that a groove which has been styled the primitive dental groove forms upon it, and that it is from the epithelium in this groove (from a part of the system which therefore corresponds to the skin) that the teeth have their primary origin; that the

deeper layers of this epithelium send processes down into the substance of the mucus membrane, which is indented by a papilla, but the sides of the indentation are separated by loosely arranged star-shaped cells. The embryonic tooth is the speck which is now entirely enclosed in its dental sac. The papilla moulds into the shape of the crown of the tooth ; the epithelium upon it in the course of time changes into enamel and dentine. The latter increases in thickness by addition to its interior, which is in close contact with the vessels from which it soon gets its nourishment. Ossification commences by the deposition of calcareous matter in the cells of the membrane at the top of the pulp. It appears in the ivory membrane first, and soon afterwards is seen in the cells of the enamel membrane : for so these two layers are styled by some physicologists. The point of most importance in this description—for there are different versions of the process—is that the teeth are epithelial structures, and differ to some extent from bone, like that of the thigh-bone, in their liabilities to disease, for the latter are derived from a different part of the skeleton, and are not liable to those mischiefs which the teeth suffer from.

A study of the teeth among the lower animals is especially interesting to the searchers after first causes, and throws a flood of light upon development. Among some of the invertebratæ the teeth

are clearly gastric, being a part of the stomach. In this position they do not depart from their epithelial character, for the mucous membrane of the abdominal tract is as epithelial as is the skin, and has the same origin. These teeth are composed of chitine impregnated with lime and silica. The teeth of the sea urchin are made up of prisms of carbonate of lime, with leaflets interspersed between the prisms, and in them we find a fine plexus of anastomosing canaliculi. It is among the shells of the mollusks that we first find a division into an outer prismatic, or fibrous, and an inner laminated tissue, similar to that in vertebrate teeth. Among the terebratulæ we find (according to Dr. W. B. Carpenter) tubes traversing the substance, forming branched horizontal channels, sometimes connected with rounded cavities, which seem to be analogous to the lacunæ and canaliculi of the *crusta petrosa*. The shell of the mollusk, which has become calcified, corresponds to the epidermis of the higher animals, and thus their teeth have the same origin as those of the vertebratæ, viz., being epithelial. The prism-like appearance is due to the cellular structure and the transverse striæ corresponding to the thickenings of the cellular membranes, where the layers come into contact with one another. My great namesake states that in his opinion the calcareous network which is seen in the shells of the invertebratæ

generally, corresponds to the fibrous structure of the cutis of the higher animals, and which has obtained a calcified condition.

Let us now ask a question or two as to epithelium, and the duties it has to perform.

1st. It is protective; of that there can be no doubt.

2nd. It is excretory.

That which applies to the whole may apply to any part. The nails and the hair are undoubtedly epithelial, and equally liable to changes which indicate alteration in the primary cells from which those organs spring. There is a difference, however, between the teeth on the one hand, and the hair and nails on the other, inasmuch as the latter are made up principally of organic substances, and are of a horny nature which is almost indestructible; it is allied to, but slightly different from, gelatine, and is sometimes styled keratin. This material therefore occupies the position of indestructibility which is held by the enamel of the teeth, but which in the latter case is mainly due to inorganic matter. Its chemical character is not clearly set out, but whilst enamel has a minute portion of organic matter in its composition, horn and nail have but little inorganic deposit, perhaps even less of inorganic matter than enamel possesses of the organic. There is thus a curious though antagonistic analogy, the minute

quantity of organic matter in the structure of enamel is the channel by which the life of the tooth is kept up; and a dead tooth, like a dead shell, is somewhat different to one that is still in direct and living contact with the body of its owner. A necrosed tooth will easily take up decay. If an expert examines the collection of a conchologist, he will be able without hesitation to point out in the collection those shells whose original bearers had died a natural death (and which had been afterwards exposed to external influence as a sequence to that death), from those which had been taken alive. A shell picked up on the sea-shore without a living inhabitant is quite different to those which are taken with the animal living in them, and which kind alone make fit addition to the collector's drawers. Changes take place very rapidly in the one kind of shell which do not show themselves at all in the other. The organic matter of the living shell is a reality, and it lives with the animal itself. The changes which take place in the dead shell are rapidly promoted by friction, by the action of the air, and by water acting upon the organic matter which, being deprived of its vitality, allows of alterations taking place in it to which it was able to furnish a complete barrier when in the living state, and in absolute union with the living animal, although it is not permeated by blood vessels, and there is no

evidence of nerve tissue in its substance. The friction on the sea-shore is not greater and the action of salt water is not different upon the dead shell to that which it has upon the living shell and animal together. Yet these actions are operative on the dead shell in the one case, and are without injurious effects in the other. The only difference between the two shells is that of the vitality of the organic matter in the one case, and its absence in the other.

Suppose we minutely examine the oyster-shell. Sections of this shell, when carefully prepared, make very pretty microscopical objects, and show markings which correspond very closely with the lacunæ and canaliculi of the *crusta petrosa* of the human teeth. Oyster-shells consist mainly of carbonate, not of phosphate of lime; the phosphorus is retained by the animal, and it does not become an excretion in the shell: it is however to be found in the constituents of the tissues. The phosphate, not the carbonate, is the principal inorganic ingredient of the human tooth. There is here, then, a manifest difference between the excretion which forms the shell of the mollusk and that which forms the tooth of the vertebrate animal. You may ask what I mean by this expression of excretion. It is simply the statement of a fact that every deposit which is made by any organ in the body is an excretion as far as

the rest of the body is concerned. The deposit is able at times to destroy the life of the rest if it be kept in contact with the body at the wrong time. That whether it is urea, which is the organic salt excreted by the kidneys, or the carbonic acid which is thrown off by the lungs, and the cholesterine which the liver gets rid of, and which is probably one of the products of nerve action ; the epithelium, which is shaken out of one's flannel shirt when the latter has been worn too long, or even any secretion such as milk or saliva, these are all excretions, and once formed they must not be retained in the organ or cells which have formed them, or mischief will result to that organ. The hair and nails are the manifestation of an excretion: the materials which form those parts, and which are intended as defensive organs, having been used up in some special work about the body, are no longer required within the precincts of that body, and being done with, the materials which form those appendages are exuded from the body. The materials of which the shell of a mollusk is formed are in the same category as those of the nails and hair of vertebrate animals. They are done with as far as the nutrition of the active organs of the body is concerned, and they become excretions, and at the same time are made into protective organs. The phosphate of lime of which the bones, and especially the teeth, of vertebrate

animals is formed, is in the same position, for it is an excretion. It is done with, and ordinarily it cannot again enter the circulation and be used up for any other purpose. There are some exceptions to this rule which allow of the excreted material being altered in its chemical character when required for admixture with other extraneous matter, and then it may be absorbed again for immediate use and ultimate removal; but as a whole, the rule is as stated. An excretion is a poison as far as the rest of the body is concerned. If that excretion is suddenly checked, and the materials which form it are thrown back again into the animal economy, mischief will result, and disease be set up. With regard to some secretions, the quantity is comparatively unlimited, but with others it is not so, the quantity is small and cannot be largely increased. We have instances of abnormal growths, such as Mr. Darwin alludes to in his work on "Animals and Plants under Domestication," in which there is a notice of the relation which holds between the abnormal growth of hair as compared with teeth; it sometimes happening that excessive development of hair has been attended by an edentulous state, as if nature could not form more than a certain quantity of some material, and if one is formed in excess there is a deficiency of the other. Two men were shown in Paris some years ago, who were father

and son. They were without teeth, but with their faces and necks completely covered with shaggy hair, like unto Scotch terriers. It seemed as if in these cases the organic matter required for the hair was provided at the expense of the phosphate of lime; or perhaps the absence of the latter excretion allowed the hairy development, and then the organic matter which was required for tooth development could not be diverted back to the dental tissues, or was not at hand at the moment at which it was wanted.

If the organism is defective in its constitutional parts at its first foundation,—if the products necessary for first development are wanting, we may have defect in the first lines of life, and hence a tendency to decay may originate at the first moment of our birth, and we may say, with Pope—

> "That man,
> The moment of his breath,
> Receives the lurking principle of death;
> The young disease, which must subdue at length,
> Grows with his growth, and strengthens with his strength."

It has been fully recognised that phosphate of lime is the principal organic element in the chemical constituents of the teeth; it also forms a large part of all bony matter; it has been assumed that the formation of bone is the main purpose for which the phosphates are required. I am bold, however, to think that this is clearly not so.

Phosphate of lime is a constituent of all organic life, or at least, some salt of which phosphate of lime is the result. It is probably the sequence of the act of living. Some portion of it plays an active physiological part in the manifestation of vital phenomena, and no life can be carried on without it, either as an active part or as a result of action. It is the principal inorganic matter which is first used up in the progress of development, and there must be depôts for the used-up material. There exists no tissue in animated nature which does not contain phosphate of lime in some form or other as the sequence of the activity of that tissue. It has an influence upon organic life: possibly in the more soluble form of superphosphate, and its presence is most likely absolutely necessary for the changes which take place in cell life. It is known that it exists largely in nerve matter. That phosphorus, or some salt of phosphorus, in some form or other, is indispensable for nerve development; and it is probable, therefore, that those bodies which are placed low in the scale of creation, and which do not possess a distinct nervous system, have a certain power, resulting from the presence of a salt of phosphorus, which enables them to carry on their nutritive and other necessary actions without the intervention of a brain, or spinal cord, or even a nerve ganglion of any kind. The presence of some salt of phosphorus is absolutely

indispensable for the formation and continuance of cell growth; and in the production of new cell life the phosphate is formed, and after a time has to be removed from its position in the animal economy. It becomes an excretion, and has to be removed from the tissues of the animal. Even before a regular nervous system is formed, and in the early days of organic life, we find its exudation prepared for by the epithelial structures.

Phosphorus is present in the lowest forms of vegetable life as well as in those which are animal. It exists in an appreciable quantity wherever there are fibres and cells. It is found as a necessary constituent in our daily food. It is abundant in milk, in fish, and in wheat. The more active the process of development which is going on, the more do the phosphates in some form or other abound. The more active the process of development is going on, the larger is the quantity of phosphorus in the organic matter of the specimen under examination. It has been shown that wheat grown in a soil completely deprived of phosphates can grow into a plant but cannot produce grain. There is a great difference, an antagonism, indeed, between animal and vegetable life in this matter, so that phosphates are not excreted as if they were used-up material by plants, but they are laid up principally as a store in the seed of the plant for future use. The phosphate does not form an intrinsic part of the

skeleton of the plant, but it accompanies the albumenoïd substance whose existence is anatomically independent of the solid tissues. It appears to be a special part of the work of the plant to secrete this in the material which it prepares for the nourishment of animals, who feed upon the result, and are able to carry on their own functions by its means. There is an important distinction, therefore, between the position of the phosphates in the one as compared with the other; and it corresponds to some extent to the position occupied by carbon and oxygen in the two kingdoms. The latter element is, as you know, excreted by the plant as the result of its organic life, the carbon being retained and used in building up the tissue of the plant; but in the animal life it is the carbon which is excreted as carbonic acid, the oxygen being exchanged for it. The phosphorus is in combination with the organic, not the inorganic, parts of the body. The larger the amount of phosphoric acid in a given quantity of organic vegetable matter, the more vigorous are the actions which are going on, and the greater is the vitality at work in the material under examination—not, however, for the purpose of forming a skeleton. I wish you to bear in mind that it is in the albumenoïd material, and not in the skeletons of plants, that phosphoric acid, or some salt of which phosphorus is the base, is most abundant, and that most plants cannot

perfect their species and prepare seed for future developments if phosphorus is withheld. There is also a point, in which there is no antagonism between plants and animals, which is worthy of notice as bearing directly upon our subject. There is a special liability to disease among plants as well as animals under certain conditions. The epidermis of plants which are not sufficiently supplied with phosphoric acid is prone to suffer from disease, and a wheat-field in which the soil no longer contains phosphate salts is very liable to blight, to rust, and to mildew. There is a kind of defective nerve power, so to speak, in the structure, which lays the plant more open to the attack of outside enemies ; whilst there is absolute failure in its ulterior development, it cannot perfect its epidermis properly. If there is no phosphate in the soil at all, the plant will grow as long as there is phosphorus in the seed itself, but no longer : as soon as this reserve is used up the nerve force is lost and the plant decays. Can we not, in this view of the matter which we obtain from the vegetable kingdom, draw some inference which may be of service in considering the cause of decay of teeth in animated nature ? If phosphorus, in some form or other, is not provided in the food we eat, it is found by every day experience that the constitution suffers exceedingly. There are conditions of life in which it is not so provided. In some of the

great cities of the Empire there is, or was, a great deficiency in the natural food which infants require for proper growth. In those places rickets (or rachitis) abounds. This is a disease of bone in which the phosphate of lime is very deficient: the bones are soft and cellular; the teeth are also defective, and the intellect inferior from inertness of cerebral action.

I am of opinion that this state is brought about by a deficient supply of proper pabulum for natural development. The child is not nourished by its own mother's milk, and cows' milk cannot be obtained in sufficient quantity and quality by the poor people in such cities: they either do not get it at all, or if they do get it, it has been watered, or it is supposed by the ignorant parents that something else is better for them. They do not get fresh vegetables, which contain phosphates in the soluble form, and they are supplied with farinaceous food, in which the larger portion of the cuticle which contains much of the phosphoric salt has been removed by decortication. The result of this kind of feeding is that the nervous system does not get its proper supply for healthy developments, and as a sequence, those organs which are dependent for their own development upon the composition which results from the act of brain cell growth, cannot be perfected. The teeth fail in their proper construction: there is

more organic than inorganic matter in their structure, and, like the proper skeleton, they cannot perform the functions which nature intended that they should do. A purely flesh diet will produce rickets, and lead therefrom to teeth failure.

On the other hand, it has been noted that if phosphorus is given in excess of the requirements of the system, as has been done sometimes by experiment, it will itself set up mischief in the bones, especially if the lime salts are withdrawn; and it is found that in those animals in which rickets have been thus produced, another material called lactic acid is found in excess in their structure and in their excretions. If lactic acid, such as usually develops in milk which has been kept too long, be given as a food, and which the poor children in our great cities too often get every day when they get milk at all, whilst phosphorus and lime salts are withheld, rickets, or at least a soft state of bone tissue, is rapidly developed.

In some large cities, such as Glasgow for instance, it happens that lime is not a constituent of the water supply. Children therefore run the chance, in that and similar cities, of having no lime provided in the water, whilst no phosphate is at hand such as milk and vegetables give; they ignore the advantage which oatmeal supplies, and which Scotchmen as a rule think much of, and as

a consequence, rickets and its allies are common diseases.

There is another disease which used to be very common in the naval service of this country in the last century, viz., scurvy. Two centuries ago it was a complete scourge in all northern Europe, as well as in our own marine service, but the discovery of its cause has materially diminished its incidence, though it is even now in our own day much more frequent than it should be, and its effects are not always recognised in the minor form in which it does even now appear amongst us, both in the sick room, and also among poor people in thickly peopled districts.

Its first incidence is upon the gums : the teeth loosen and decay ; there is a tendency to hæmorrhages and effusions of blood from mucous membrane ; the slightest injury to the skin produces a bruised appearance. The cause for this condition, in my opinion, is the absence of fruit and vegetables from the common diet of the sufferers. The effect of fresh fruit is to diminish those acids which result from the consumption of a flesh food, which is too highly nitrogenous. The alkaline vegetable salts which fresh fruits contain, become decomposed into carbonates, which pass off with the urine, and take with them or assist to discharge by other means some of the nitrogenous matter which exists as *débris,* which would, if left there, form lithic

acid and its allies. The small quantity of a phosphate salt which they contain is used up in nerve nourishment, and a phosphate of lime is prepared. Fruit and vegetables are extremely advantageous, therefore, in those conditions of the system in which there is a lithic acid diathesis: they prevent the formation of urate of soda, which often by its deposition in the peridental membrane, induces those diseases of the teeth to which the gouty classes are especially liable. Improper food in infant life does lay the foundation of disease in the dental appendages, which, following upon those produced by hereditary causes, are very serious in their result. So improper feeding in our later days will do the same. I sometimes meet with people who never touch fruit or vegetables in their daily diet. They are on the high road to suffer from those diseases which result from a diet which is too nitrogenous—such diseases as gout, fatty degeneration, scurvy. They are depriving themselves of the pabulum which is necessary for the proper nourishment of both nerve and bone, and are keeping within the precincts of their body material which ought not to be there. They either have lost or will lose their teeth sooner than other people, simply because the supply of material necessary for maintenance is not afforded. I sometimes meet with sick persons who have bleeding gums, continuous neuralgia, many carious

teeth, and a tendency to hæmorrhage produced by the slightest injury; who never touch fruit, and seldom eat vegetables, because they believe that those articles disagree with them, and, as they suppose, set up dyspeptic and other gouty complaints—just as some people will not allow the housemaid to dust their libraries and book shelves because of the dust they are likely to kick up, and the displacements which are sure to follow. Is it a wonder that dust and dirt abound in that library, and *débris* of a wrong character finds a settlement in those positions in which such *débris* is out of place? It is just so in the human economy. If the diet is not of a proper kind, if some elements are ignored altogether which nature intended us to take, there is sure, sooner or later, to be a defect in our excretions, and the fundamental condition of the body is altered. It is possible that the teeth are the depôts for the deposit of the phosphate of lime, which is formed in very minute quantity in the first months of human life, and before the bones are ready to receive it, it may be the *débris* of the first nerve cells which form in the infant. Let there be some defect in innervation as may arise in the progeny of a syphilitic individual, and we may see the result in the defective character of the phosphate of lime which is deposited in the cells of the ivory and the enamel membrane of the new

development. It is not a pure salt, it contains something else besides phosphate, and as a result the cells themselves are imperfect, both in shape and number, the striæ upon them are unerring witnesses of the taint which the father has inflicted upon his own progeny, and which taint will probably show itself later on in the life of the child, by defective nerve centres, by a mental weakness, or it may be by paralysis, or by insanity, and other nerve disorders, which will require much care to prevent their development, even if they can be prevented.

The dentist has a serious duty to perform when these cases come to his notice, viz., to inform the parent of the constitutional taint which exists in the child, and to advise that measures be taken to diminish its incidence, by counteracting its influence by such means as temperance, chastity, and correct diet. The children of this class are more prone to nerve disorders than other people, those nerve disorders often being of the most painful kind. A warning to the parent, and if the child is old enough, a warning to himself, that there is very much to be done to get rid of a taint which touches the foundation of life, and affects the battery before it can show its results in the *débris* of that battery. How this effect is first produced is unknown to us, but that it does show itself in the second and even a third generation is now

fully acknowledged, and it ought to be taught to young men as one more argument against the vice of unchastity and the danger of uncleanliness. The sequence is probably due to failure of nerve growth ; the teeth are sometimes shed even before they are fully formed. The teeth cannot develop, because the material required for their production is not properly formed : there is no *débris* of the right kind.

Caries also is probably favoured by the condition which promotes tubercular tendencies. A minute particle of perverted protoplasm is laid down in the cell membrane which forms the dentine. It is chemically defective from having a tendency to fatty degeneration rather than to a proper deposit of phosphate salt. A single cell may be thus impaired by defective structure, or half-a-dozen cells may be touched. As time goes on the defective cells soften, and, by means of the imperfection of the organic matter which pervades the tooth, which is in excess of its requirements, there is a want of proper balance between the enamel, dentine, and the organic matter ; there is defectiveness in their composition as well as in the support which is required, and in consequence the tooth is more liable to wear and tear than would have been the case if the inherited defects had not existed ; a small hole is punched in the tooth, which, if not resisted by the dentist, will give a *locus standi* to foreign

bodies, to vibrios and to bacteria, and thus allow of assaults being made upon the tissue which is still sound by the secretions which the living organisms produce in the cavity of the tooth, and caries then arises.

An attempt is generally made, though unsuccessfully by nature, if not assisted by art, to remedy the mischief. A small amount of chemical action takes place in the hole, which, failing in its object, in the course of time leads to extension into the pulp cavity, and ultimately to the total loss of the tooth. It is necessary for the best interests of the children of tubercular parents, that their teeth should be frequently inspected by the dental surgeon, and those punch-like holes cleared out and stopped before the pulp cavity is reached. In these cases the conservative power of the dental surgeon is very manifest. He should advise a close attention to the rules which the obvious tendencies to tubercle require to be observed. He should urge upon the parents of such children to beware of the mischief which, unless due care is exercised, will be in store for them. If germs of perverted protoplasm are found in the dental organs, they will be found in other tissues. I have reason, however, to believe that when such tendencies show themselves on epithelial structures in early life, and when the deeper seated organs are not at the same time affected, that there is

a greater chance for hereditary conditions to be overcome. The tendencies to disease being limited to epithelial tissues, it is reasonable to hope that, with due attention to the rules which should be observed for securing a healthy state of body, that there will be an evacuation of *materies morbi*, and so the child may escape from the evils which it has inherited.

I have seen in some families, where the syphilitic taint has been undoubted, that those children with defective teeth who have skin eruptions, in whom the defect has been recognised, and all exciting causes for further mischief withheld, such as the abuse of mercurial medicines and excessive use of animal diet, that they have escaped the evils which have befallen other members of the family in whom the epithelial structures have not been at first affected, but in whom cerebral mischief has shown itself at an early date. I have seldom seen the presence of tertiary syphilis on young children without finding evidence of mischief in the teeth, the hair, the nails, the epidermis, all more or less showing the taint. In other instances I have also seen the teeth alone giving such evidence, and in those cases the individuals have grown up to man's estate in fairly good health, though the chances of such results are not great. But if in addition to the taint, as shown by the epidermis, there is also some organic disease in some of the splanchnic

viscera, there is no likelihood that the child will make old bones, or even grow to man's estate. A large number of those cases in which early death arises from cerebral disease are closely connected with hereditary syphilitic taint, and the insight as to cause is obtained from the irregular, the jagged, and stained condition of the dental organs. We get a similar insight into the tubercular tendencies in certain families. The teeth are not irregular, and jagged, and stained, but they are thoroughly carious—there is a want of true bone, of true enamel. The material provided is fatty and friable, and with this state of the teeth we have generally a tendency to bow legs and soft, irregular skulls. In these cases it is defective innervation from the first, which has arisen from foul air, defi cient sun-light, and bad food. All these causes have been at work upon the organization of the parents, and show themselves in their progeny. A continuance of such causes acting upon the child increases very much the tubercular tendencies which exist in the constitution, and render him more easily liable to be influenced by cacozymes or septic bacteria, which are more easily developed and flourish most in foul air and dimly lighted dwellings. Children therefore having the first set of teeth carious, require something more than surgical aid. The parents should be advised to avoid the causes which promote septic developments, to cultivate

the benefits which are to be derived from the beneficial influence of sun-light, from a pure dry air, and from simple, unstimulating food; and the surgeon who only attends to the teeth has only done a part of his duty; but it is also only fair to say that this class of cases seldom comes into the charge of the surgeon-dentist at all.

I have seen conditions in strumous children similar to those born of syphilitic parents. When the evil has fallen upon the epidermis, and has shown itself in defective teeth, with scaly or vesicular eruptions upon the skin, the internal organs have escaped, and the children, having thrown out the morbid matter which they inherited, have grown up into healthy and well-developed individuals: that is, provided the laws of health have been observed, good unstimulating food, fresh milk and vegetables used, and fresh dry air with sun-light sought for. I have on three or four occasions seen two or three children in the same family with bad temporary teeth and exzematous eruptions, yet grow up satisfactorily, whilst those with clear skins, and not showing any defects in the epidermis, have died in early life of cerebral disorders or mesenteric disease of a tubercular character.

The effects of the gouty diathesis do not show themselves so markedly upon the teeth in early life, as is the case with the syphilitic and the tuber-

cular states. The tendency to disease which this diathesis does promote among the descendants of gouty people, is more likely to manifest itself in another way, and other tissues suffer more than the teeth, though caries is not uncommon. The quality of the nerve cell is not necessarily damaged in a gouty man, and as a consequence the teeth do not often suffer. The children of gouty people experience tendencies to blood maladies which (just as syphilis in the beginning of life) affect in the end every organ of the body; but it is in connection with the nitrogenous material and not with the phosphorus of the constitution—the organic rather than the intellectual regions of the body suffer from its incidence.

The rise of gout and its sequences are connected with excess of material, and with derangement of the digestive organs which is the consequence of that excess, rather than to the introduction of an extraneous poison, or by the action of an arrested growth. Syphilitic taint is probably due to a parasitic life; tubercular growth arises from the presence of perverted protoplasm in the blood, in which bacterial or other forms of parasitic life can increase and multiply. Syphilitic conditions are due to a taint which will affect every person into whose organization its first cause finds admission, and from whose tissue it has not been

immediately ousted. The tubercular will only develop in those persons who have lived unhealthy lives: its influence is continued by their surroundings; whilst gout is not brought on by either of these conditions: it is a state induced by excess, and its sequences are on different lines: the surroundings may be quite healthy, but the habits are vicious, indolent, and self-indulgent.

The conditions which produce it are not common to, and are not obtained in, early life. They more often arise after the man has attained his full growth. His progeny are born into the world, in the majority of cases, before the humours of the body have been able to act injuriously upon the sexual organs. It is seldom that a constitution is thoroughly gouty before a man is forty or fifty years of age: thoroughly gouty men do not have families, to any extent, after they have become saturated with gout; thus the specimens afforded us are limited as far as children are concerned. Still it is, I think, a fact that the teeth do decay sooner in some of those who are descended from gouty parents: they are more subject to caries, which disease has its origin in fatty degeneration of the dental cells, and the subjects of it are especially liable to those peridental inflammations which ultimately lead to necrosis. Gouty men and women also suffer very much from neuralgia and other conditions of the system which have their

origin in a lithic acid diathesis, and they can only be properly cured by associating the dental treatment with a proper diet, and the judicious use of remedies against the gouty tendency. The presence of a lithic acid diathesis is often accompanied by pain which reflects itself upon every function which the body has to perform. Indeed, the state of the mouth is frequently the Nemesis which attends upon over-indulgence; for the tender state of the gums and teeth puts an end to feasting, and induces that fast which is the true cure for excess of nitrogenous material in the blood.

Future history will show whether the children of total abstainers have an advantage over those of non-abstainers as regards soundness of teeth. At present there is no proof that the acknowledged benefit of total abstinence does give any immunity as regards hereditary dental disease, but that abstinence does assist to save the teeth of the goutily inclined, I have had too many instances before me to doubt the fact, whilst the sufferings which stimulants induce in those who indulge in them is also as manifest. Celsus writes in his sixth book, "De Medicina": "*In dentium autem dolore qui ipse quoque maximis, tormentis annumerari potest, vinum ex toto circumcidendum est. Cibo quoque primo abstenandum.*" That ancient and generally accurate writer is very

decided upon this point, and yet it is curious how some modern physicians ignore the teaching of that acute observer, and prescribe alcohol in all its forms, and in excessive doses, for the relief of dental neuralgia, with the moral certainty that they are only postponing the evil day, and adding to its ultimate intensity. The paralysis which alcohol induces in the vessels supplying the sentient nerve gives temporary relief, but the pain of to-morrow is all the greater from the anæsthesia of to-day. If two patients, suffering from dental caries, and who are intent upon continuing the presence of the offending organ in the mouth, the one who submits to the pain without using anæsthetic remedies will get over the action which is causing the neuralgia much sooner, and will get earlier relief, with a far less expenditure of patience in suffering, than the man or woman who flies to stimulants for temporary relief from their distress. The alcohol simply delays the action which is necessary for the removal of the exciting cause, and does not at all assist to its cure. In theorising, however, upon the subject of alcoholic indulgence, we must bear in mind that, as a rule, children are total abstainers; but I believe that if we could separate those who suffer from hereditary causes from those who have no hereditary taint in their dental appendages, and then follow the total abstainers through life, and compare them in their

decline of years, I think it would be found that the total abstainers had suffered comparatively little from neuralgia, or any painful malady in the dental organs, as compared with the wine-bibber.

I do not yet know enough of the alliance between dental diseases and rheumatism, or of the connection, if any, with the cancerous cacexia, to make any specific allusion to those tendencies, even if time would allow me to do so, but there is a field for observation in connection with the development of lactic acid in the constitution, and the rheumatic diathesis, which the state of the teeth might assist to determine. I leave that for others to follow out. If I have given lines for future thought to those who have a more immediate connection with the results of dental disease than I have, I shall have effected my object. I think that our design should be, not the establishment of a foregone conclusion by bending our facts to our theories, but a steady observance of facts, a correct registration of conditions, and then in the end a proper generalization may be obtained, which will be based upon the truth. This should be the desire of every one of us to get established upon a sound and satisfactory line, even if its establishment should lead to a large diminution of that work which has already taken place in hospital practice, and made conservative surgery of more importance than heroic performance. It will

materially diminish extractions, and render prevention of disease of greater import, even to the surgeon dentist, than its radical cure can ever be.

Discussion.

After a few words from the President, inviting discussion—

Mr. Oakley Coles said it was evidently quite impossible within the short time which remained at their disposal that evening, to do justice to such an elaborate and interesting paper as that which they had just heard, containing so many points which would serve as starting points for discussion. It did not often happen that they had so observant a physician as Dr. Carpenter to read a paper before the Society, and it would be a pity if they did not make the most of such an opportunity as the present in order to ascertain his views on points of medico-dental interest. He would therefore propose that the discussion be adjourned until the next meeting, by which time members would have been able to read the paper in print quietly and carefully, as it deserved, and indeed required to be, and they would then have ample time to discuss it properly.

The President said he was very pleased to hear Mr. Coles' proposition. Dr. Carpenter's paper was certainly a most important communication, containing many suggestive points for careful consideration. He would at once put the motion of adjournment to the meeting.

The motion was carried by a large majority.

The President said it only remained for him to offer the thanks of the Society to Messrs. Coleman, Redman and Tomes, for their interesting communications, and to Dr. Carpenter for his very valuable paper.

Dr. Carpenter said he was very much obliged for all the kind things which had been said, but he felt bound to state that, although he had long taken a great interest in the subjects referred to in his paper, he had but a slight practical

acquaintance with the actual work of the profession. He had no doubt, therefore, that they would be able to find several weak points in his paper. It had, however, been written to excite discussion, and when the time came he hoped they would not spare it.

The PRESIDENT then announced that at the meeting on December 4th, after the discussion on Dr. Carpenter's paper, Mr. Charters White would read a paper on "The Salivary Glands of Insects."

(The meeting was then adjourned.)

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

December 4th, 1882.

S. LEE RYMER, Esq., President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

The President stated that the votes of condolence which had been passed by the Society at the previous meeting had been duly communicated to the relatives of the late Mr. Clover and of Mr. Alfred Canton, and letters had been received from them thanking the Society for its sympathy, which they very highly appreciated.

Mr. Thomas Read signed the Obligation Book, and was formally admitted to membership by the President.

The President announced that the following gentlemen had been duly nominated as candidates for membership, and would be balloted for at a subsequent meeting, viz.:—

Messrs. Chas. Moulden Bayfield, L.D.S.I., of Talbot Road, Westbourne Park, W.

John Bayly, 353, Clapham Road, S.E.

Thos. Bird, 38, Brook Street, Grosvenor Square, W.

W. A. Carpenter Harris, M.R.C.S. and L.D.S. Eng., 26, Finsbury Square, E.C.

Fredk. Harris Newton, L.D.S.Eng., 50 Brook Street, Grosvenor Square, W.

Alfred Smith, L.D.S.Eng., of Devonshire Road, Holloway.

Edward R. Hockley, 198, Parrock Street, Gravesend.

John Mitchell Humble, Marsh House, Rothwell, Leeds.

George J. Lucas, L.D.S.Edin., Northfleet, Kent.

Henry Clay Quinby, 21, Rodney Street, Liverpool.

Melville G. C. Quinby, 21, Rodney Street, Liverpool.

Alfred Rogers, 2, King's Parade, Cambridge.

Walter Smithard, L.D.S.I., 15, Stratford Road, Manchester.

Sidney Greatrix Yates, Berkeley House, Ross, Hereford.

Mons. Paul Hypolite Victor Poinsot, of Paris, was then balloted for and elected a Corresponding Member of the Society.

Messrs. Walter Coffin and Henri Weiss were appointed to audit the Treasurer's accounts at the end of the year.

The Curator (Mr. S. J. Hutchinson) said he had received an upper molar from Mr. Hatton, of Hulme, Manchester, who described it as a "very rare specimen. The pulp was dead, the fangs much thickened and somewhat absorbed at the apices, and on being extracted it was followed by a copious discharge of pus, mixed with blood."

He also showed the head of a rabbit which had been lent to him for exhibition by the editor of "Land and Water." It was shot at Trafalgar, the seat of the present Lord Nelson; it weighed $3\frac{1}{4}$ lbs., and was very fairly well nourished, though how it could have managed to feed was a puzzle when one came to look at its teeth. The upper incisors formed nearly three-fourths of a circle, the extremities entering the mouth; whilst the lower were equally long, but, being less sharply bent, curled out in front of the nose.

Mr. George Brunton, of Leeds, then read the following communication with reference to a new process of hardening dental rubbers :—

This consisted in using pulverised steatite (soapstone) instead of plaster of Paris. It was used dry ; no special flask was needful ; indeed, no flask at all was required : any tin box which would hold the case and allow space for an investment of steatite to cover it all over, would answer the purpose. Of course this method required that the packing of the rubber should be done before the case was put into the box or flask. During the last three years all the rubber work done in Mr. Brunton's work-room had been done by this process. To prevent contact between the rubber and the plaster of Paris mould, Mr. Brunton was in the habit of coating the surface of the model with liquid silex. This gave the model a hard smooth surface, and left a smooth surface on the palatal side of the case which required little or no finishing. The lingual and labial surfaces of the case were covered with tinfoil, which kept it in form and prevented the steatite from sticking to the rubber. The hardening might be done in any vulcaniser in the usual time and at the ordinary temperature, but after a considerable number of experiments, Mr. Brunton had found that the best machine for the purpose was Dr. Campbell's New Mode Heater. He got the steam up to 60 lbs. pressure, then put in the case, screwed up the door, and let just a puff of steam into the hot chamber. The valve was then closed, and, after seeing that all was steam-tight, the apparatus was left for three hours, the pressure being kept at 60 lbs. This produced the most dense and tough rubber Mr. Brunton had ever met with.

He had obtained the sp. gr. of bowspring rubber before vulcanising, which was 1·4632 ; after vulcanising in plaster of Paris it was 1·5103 ; but after vulcanising in steatite it was 1·5278, the time and temperature being as stated above.

Many years ago he had asserted that the process of vulcanisation proceeded from the circumference of the piece towards the centre. He had been able to catch the process at work, and was now able to show specimens by which it would be

seen that the outside edges of the rubber were harder than the middle.

He would sum up the advantages of the steatite process thus:—Greater toughness, greater density and hardness in the cases, no porosity, no raised bites, less risk in the process of vulcanising.

Mr. Brunton then opened one of Dr. Campbell's vulcanisers, which he had in the room, and handed round some specimens of rubber which had been hardened in the course of the evening by the steatite process.

Mr. Walter Coffin said the process which had just been described by Mr. Brunton was that ordinarily used in the manufacture of small rubber articles not vulcanised in metallic moulds. For instance, umbrella-rings, door-springs, &c., having been shaped in the raw masticated material, were simply packed in a box with powdered steatite, and subjected to dry heat. It was certainly the opinion of manufacturers that contact with moist plaster, or wet steam, was injurious to the texture of their goods, and also that a certain amount of expansion occurred in vulcanising.

He thought Mr. Brunton must be mistaken in attributing a closer adaptation of the rubber on the mould to the pressure of the steam, which in porous plaster would act alike on both sides of the plate.

Mr. George William Parkinson exhibited a model, and related the following particulars of a case which had occurred in the practice of his uncle, Mr. George Parkinson, of Bath:—

Twenty-five years ago the patient, who was a butler, had a large swelling on the right cheek which was very painful, and for which he consulted a surgeon, who made a very considerable external opening into it. From that time until nine years since, when he consulted Mr. Parkinson, he had a constant discharge from the unclosed wound. An examination of the mouth at this period showed some very diseased stumps which, being thought to be the primary cause of the mischief, were removed under the influence of nitrous oxide gas. For some time after this the patient experienced considerable

relief, but in the following year pain returned, and the only tooth (a molar) remaining on that side was removed, and Mr. Parkinson, feeling sure there was pus in the antrum, made an opening into it with a trocar: a considerable quantity of pus escaped; the operation was followed by immediate relief, and the wound entirely closed. All this happened eight years ago, and the patient remained free from pain until the spring of this year, when he began again to experience some of his old symptoms, with much throbbing. Being in London at the time, he consulted Sir James Paget, who saw, protruding from the spot in the antrum where the perforation had been made, what appeared to be the cusp of a tooth. Sir James then wrote to Mr. Parkinson, suggesting that the tooth should be extracted; this was done with some difficulty, but with very great relief to the patient, who has since been perfectly cured. Sir James Paget said in his letter that he considered it a most interesting case, the like of which he could not remember to have seen before, and he asked Mr. Parkinson to publish it, at the same time requesting him to present the model and tooth to the Museum of the Royal College of Surgeons. But Mr. Parkinson's sense of loyalty to the Society prompted him to refuse this request, and he had sent it to be added to the Society's collection. Mr. G. W. Parkinson had great pleasure in presenting it accordingly in his uncle's name.

Mr. Redman exhibited a model showing two supernumerary teeth *in situ*, and also handed round the teeth themselves, which had been extracted.

He also brought before the notice of the Society a preparation called Eugenol, which had lately been obtained from oil of cloves. It was an anodyne, and was especially useful for obtunding the pain of sensitive dentine: a little should be applied from time to time to the surface of the dentine as it was being excavated.

Mr. Coleman said he thought it worth mentioning to the Society, that he had that day seen a little girl, aged only four and a half years, who was actually cutting the two permanent central incisors of the lower jaw.

The PRESIDENT then called upon Mr. Oakley Coles to open the adjourned discussion on Dr. Carpenter's paper, read at the last meeting of the Society.

MR. OAKLEY COLES said he thought the Society was greatly indebted to Dr. Carpenter for the valuable paper he had read at the last meeting. It contained many points which might serve as bases for discussion, but as the time at their disposal that evening was limited, and there were no doubt many others present who were wishing to express their opinions, he would confine his observations to three points in the paper, and would refer to them as briefly as possible.

In the first place Dr. Carpenter had stated that necrosed teeth were very liable to decay. He (Mr. Coles) thought that the experience of the profession was that a necrosed tooth was not more liable to decay than other teeth, so long as it was retained in its natural position, but that if removed from its socket and placed in a denture it was liable to decay. Dr. Carpenter also compared a dead tooth to a dead oyster-shell, thrown up by the sea and altered by exposure to weather and friction on the beach. But he (Mr. Coles) could not see that this comparison held good; for so long as the animal was living, the shell was not tossed about—it was anchored, and it was only after the death of the animal that it became subjected to altered conditions. The tooth, on the other hand, remained under the same conditions throughout.

In the next place Dr. Carpenter had said that the teeth were excretory organs—that they took up waste products. But this idea seemed to him (Mr. Coles) scarcely tenable; for these elements (the phosphates) were essential to the vitality of the organism, and he could not see how a substance which was necessary for the nutrition of the tooth could be considered a waste product.

Then Dr. Carpenter stated as a fact that the children of gouty parents were very liable to dental caries. He (Mr. Coles) thought that the experience of the dental profession was that those who were the subjects of inherited gout had large strong teeth, which were but little liable to be attacked by caries, but which were liable to be cast off by recession of

the gum, or as the result of chronic congestion of the alveolo-dental membrane.

Dr. Carpenter's reference to the effect of rheumatism on the teeth was not very clearly expressed, but he (Mr. Coles) took it to mean that Dr. Carpenter had not been able to observe any direct connection between rheumatism and dental diseases. But the experience of the dental profession certainly was that acute rheumatism had a very definite and often a most disastrous effect on the teeth; for it was liable to be followed by the worst form of caries—that known as "soft caries."

Dr. Carpenter had referred in his paper to the Kostruma people, who, he says, "were exhibited in Paris some years ago; they were without teeth, but with their faces and necks completely covered with shaggy hair, like unto Scotch terriers." Now these people were not only exhibited in Paris, but were also shown here in London, and were carefully examined by Mr. Chas. Tomes and himself. He had taken models of their mouths, which were, he believed, to be found in the museum. These people were not covered with "shaggy hair," but with the finest silky down; and they were not "without teeth," for both father and son had four teeth in the lower jaw, and the former had also one in the upper.

There was one other point in Dr. Carpenter's paper to which he would briefly refer, and that was the statements made with regard to the punishment of children in this world for the sins of their parents, and the system of pains and penalties which Dr. Carpenter asserted would, as a consequence of this, be visited upon the parent in the next. "The pains," he says, "which the children innocently suffer in this world are to my mind the punishments which will have to be endured by the father in the next." This, in Mr. Coles's opinion, was not only a matter altogether beyond the subject under discussion, but it was one of which neither Dr. Carpenter nor himself were competent to judge. In fact, the statement savoured very much of what was known in schools of divinity as "dogmatic theology"—propositions which must

be believed on simple assertion because they were incapable of proof. He (Mr. Coles) could not for a moment believe that a man who in the course of his professional duties inoculated himself with syphilis, and who then transmitted the disease to his offspring, would be punished because his children had "innocently suffered."

There were other statements in the paper to which he might refer, but as he believed there were several members ready to take up the discussion, he would not detain the meeting with any further criticisms.

Mr. A. Woodhouse said the text of Dr. Carpenter's paper was that "prevention was better than cure," and he thought it might be worth while to relate to the Society a case which had come under his own observation, which was a good illustration of the truth of this proposition. One of his friends, now dead, was a gentleman of very delicate constitution, and he had very bad teeth; he was one of a large family, all of whom had bad teeth. This gentleman married a lady of good physique, but who had then no less than fifteen stoppings in her mouth; he was in very weak health at the time of his marriage. Soon afterwards they both became vegetarians, eating bread made from whole crushed wheat, and being in all respects most particular and regular in their diet. They had two children, of whom one died, but the eldest was now a young man, about 19 years of age, *and he had perfect teeth.* Mr. Woodhouse attributed this to the fact that the mother had during her pregnancy lived upon plain wholesome food, just what Dr. Carpenter had pointed out as most suitable, and the boy had also been brought up in the same way: he had plenty of porridge, brown bread, and such like. He (Mr. Woodhouse) thought this was a good example of what might be done by careful management to overcome a special hereditary predisposition.

Mr. Henry Sewill said Dr. Carpenter's paper inculcated a truth which could not be too often impressed upon the public, viz., that if men were educated up to the level of science there would be very little disease. It was a fact that most diseases were preventible; syphilis was preventible, and so were

dental diseases. This truth must be preached until it was generally recognised.

But although the object of Dr. Carpenter's paper was a good and useful one, there was certainly much in it that was open to criticism. Dr. Carpenter's facts could not all be accepted without question, and some of his conclusions also were at least doubtful. We had already a very good foundation of established fact from which to draw our conclusions with regard to the causation of dental caries. Indeed it might be said with regard to dental diseases generally that there was no mystery about them. We knew more about the anatomy, physiology, and pathology of the teeth than we knew with regard to any other organ of the body. Nor was this to be wondered at, seeing that they were really external organs, and constantly open to observation. There was, however, a certain class of writers on dental diseases who tried to make them out as being difficult of comprehension, and who invented very far-fetched solutions for exceedingly simple problems.

For instance, with regard to the causation of caries, there could be no doubt that it was wholly due to the action of external agents. It was not due to any change in the pulp or in the periosteum: it did not begin in the pulp cavity, but on the external surface of the tooth. Nor did it depend on any constitutional state affecting the teeth through the medium of the circulation, but was entirely due to the state of the mouth.

It was in the first place very important not to confound the predisposing with the exciting causes. The predisposing causes were structural defects in the teeth and arrested development of the jaw, causing overcrowding of the teeth. The structural defects were pits in the enamel and soft dentine, *i.e.*, teeth with imperfectly formed tissues. There was no doubt that hereditary syphilis did cause defective teeth. The investigations of Mr. J. Hutchinson and others proved also that some defects were due to the administration of mercury. As regards other causes it might be said generally that whatever affected the growth of the bones affected the teeth also; where

the bones were imperfectly ossified the teeth would also be bad. He could not agree with what Dr. Carpenter had said about gout being a cause of organic inferiority of the dental tissues: he was strongly of opinion that it had no predisposing influence whatever.

The *exciting* cause of caries was the action on the teeth of the products of decomposition formed in the mouth. Acids were produced as the result of the fermentation of particles of food, &c., and this, permeating the porous enamel, acted upon the dentine. Then the recent investigations of Messrs. Underwood and Milles had added something to our knowledge by showing that the progress of the disease was assisted by the proliferation of micro-organisms in the canals of the dentine, these bacteria having also themselves the power of producing an acid secretion. Altogether, as he had already stated, the etiology and pathology of dental caries were not mysterious.

He agreed with what had been said by a previous speaker about the comparison between the dead oyster-shell and the so-called dead tooth: it was certainly not a fact that a necrosed tooth was more liable to decay than a living one.

Mr. Redman said he had no doubt that Dr. Carpenter was quite right in attributing the gradual deterioration of the teeth which was now taking place in part to the effects of hereditary syphilis and gout, but he was surprised that Dr. Carpenter had not alluded to another very important factor. He thought that the comparative disuse of the teeth at the present time contributed largely to influence the change. It was a well-known physiological fact that organs which were much used improved in structure, whilst those which were not fully used deteriorated. Savages, who ate coarse food, and did not use a knife and fork, had good teeth, whilst people like ourselves, who had soft, carefully cooked food, had bad teeth.

He should like also to ask Dr. Carpenter whether he had paid any attention to the effects of vaccination on the teeth? He was not himself an anti-vaccinationist, but it had been asserted that wherever vaccination had been introduced there

the teeth had deteriorated. He should be glad to hear Dr. Carpenter's opinion on this point.

Mr. Henry asked whether it had really been demonstrated as a fact that dental caries was more common now than formerly. No doubt it came under observation more, but might not this be due to the fact that people now paid more attention to the preservation of their teeth, and consequently applied more frequently for treatment and advice?

Mr. Coleman said that question could only be answered by the experience gathered by dental practitioners who had attended two or three generations of the same family, and their report was that it was very seldom that a child had better teeth than its parents, whilst in a large number of cases they had very much worse. And, secondly, by the careful examination of a large number of ancient skulls and a comparison of them with an equal number of modern mouths. This form of investigation he had himself carried out to some extent. He had examined several hundreds of skulls, of various degrees of antiquity, and he found that there was no comparison between the carious teeth found in them and the number that was seen in the mouths of the people of our own day.

Dr. Walker said, from experience gained during eighteen years' hospital practice, he could certainly say dental caries had increased in frequency.

He could not agree with Dr. Carpenter in thinking that gout predisposed teeth to caries. He agreed with Mr. Redman that disuse was one main cause of imperfect dental development; children sucked their food through faulty and decayed teeth, the mucous membrane becoming generally congested around the necks and sockets of the temporary molar teeth. But he thought there could be little doubt that want of use of the teeth, especially in early life, the amount of mastication required being reduced to a minimum, was a cause of decay. He had lately met with a gentleman who had lived for many years in New Zealand, and he assured him (Dr. Walker) that when he first went there toothache and caries were almost unknown amongst the Maories, but now decay was common.

Mr. S. J. Hutchinson remarked that Dr. Carpenter had said at the last meeting that he hoped his paper would be freely criticised. He (Mr. Hutchinson) thought that Dr. Carpenter could not complain of any want of freedom in the style of the criticisms which had been passed upon it that evening. He was very much obliged to Dr. Carpenter for his kind invitation, and would gladly avail himself of it.

He thought that although inherited tendencies might have something to do with the spread of caries, there was very much to be considered in the circumstances under which the teeth were formed. There could be no doubt that the temporary teeth were much more liable to decay now than they were formerly, and he (Mr. Hutchinson) attributed this in great part to the way in which mothers lived during their pregnancy.

It should be remembered that at the fourth month of gestation, the papillæ appeared which were to form the basis of the future teeth; a little later a cap of dentine was formed on these, and at the time of birth the teeth were, many of them, to a great extent calcified. How greatly must the nutrition of the mother during this period influence the structure of the teeth of the child. If the mother lives an artificial and unhealthy life it cannot be expected that she will have healthy children. The mothers of savage races lived very differently. Then the great majority of children were not properly fed during the first nine months after birth, and during this time much mischief was done to the second set of teeth, then in process of formation.

With regard to Dr. Carpenter's statement that the phosphates were an excretion, and that they were taken up by the teeth and bones because they were no longer wanted, he (Mr. Hutchinson) thought there was an important difference between the teeth and bones which should not be overlooked, viz., that whilst the bones were constantly undergoing structural change, absorption taking place at one part and deposition of new material at another, the teeth, when once formed, underwent but very slight alteration in structure; he thought, therefore, that the processes of growth and nutrition of the

two sets of organs being so very different, it was scarcely safe to generalise respecting them in the way Dr. Carpenter had done.

With regard to Dr. Carpenter's remarks on the influence of syphilis on the teeth, he would ask him whether he did not think that the defects in their formation were not in some cases due rather to the effects of the mercury which was administered with the view of contracting other manifestations of the disease, than to any direct and specific action of the hereditary taint on the organs themselves. He should also like to ask Dr. Carpenter what he meant by the "striæ" which he had spoken of as being met with in syphilitic teeth.

He did not quite understand also what Dr. Carpenter meant by the presence of "imperfect cells" in the dentine as a cause of decay. Probably Dr. Carpenter had good grounds for his statement, but the way in which it was put in the paper did not appear to him (Mr. Hutchinson) to be quite clear, as it implied that caries could commence in the dentine even when covered by strong enamel.

Finally he thought that Dr. Carpenter had not, in one respect, given the dental profession quite as much credit as was due to it. He had spoken of the gourmand being turned from the error of his ways by the loss of his teeth, which resulted from repeated attacks of gouty inflammation of the gums. He could assure Dr. Carpenter that when this came to pass they could supply the gourmand with very efficient substitutes for the organs he had lost, and could thus enable him to continue his feasting with as great a zest as before.

The PRESIDENT having called upon the author of the paper for his reply,

DR. CARPENTER said he was much gratified at the amount of criticism to which his paper had given rise, but he was somewhat surprised at the direction this criticism had taken. His paper contained certain propositions which he had dressed up with some amount of colouring and framework; and he might say of the criticisms generally that they dealt chiefly with the decorations, whilst the more important ele-

ments of the paper, some of which he fully expected would be debated, had scarcely been referred to.

This was especially the case with regard to the remarks made by Mr. Oakley Coles, who had dealt with the frame rather than the picture This gentleman had said that a necrosed tooth was not more liable to decay than a living one; but it must surely stand to reason that dead matter was more liable to decay than living.

Then he had said that the change in the dead oyster-shell was due to the fact that whilst the animal was alive the shell was fixed, but that after death it became exposed to the action of the waves, and suffered from the effects of friction, &c.; but the fact was, Mr. Coles had not understood the meaning of the passage. The statement in the paper was not made of the oyster-shell alone, but of "the shells in the conchologist's collection," and although oysters were fixed during life, the majority of the molusca were not; yet it would be found that whenever the animal had been taken alive the shell would be bright and smooth, but that if the animal had died, the shell would be faded and dull. As soon as the animal died changes began at once in the shell, from influences which were inoperative whilst vitality was present.

It had been said that he was mistaken in his opinion that the children of gouty parents were specially liable to dental caries. But as the result of forty years' experience of medical practice, he himself had no doubt as to the fact that the children of gouty parents *were* more liable to caries than were those who had no hereditary taint. He might add that, unfortunately, he had *not* read the papers on dental subjects to which reference had been made by Mr. Sewill. The statements made in his paper were the results of his own personal observations, made in the course of an extensive practice, carried on amongst a large well-to-do population, a considerable proportion of whom had some sort of hereditary taint.

It had been suggested by one speaker that the imperfect development of the teeth of syphilitic children was due to

the mercury which had been given them with the view of checking other manifestations of the disease; but this was not the case. He could mention three families which had come under his own observation, in each of which the children had typical syphilitic teeth, yet none of them had taken mercury. He had made special inquiries on this subject of the parent, who was his informant. There was, most distinctly, a direct connection between the notches and striæ on the teeth and syphilis.

It had been stated that he had said that there was no connection between rheumatism and caries. He had not said so. He had said that "we did not know enough about the alliance between rheumatism and caries." There was undoubtedly an alliance, but it was difficult to place the exact facts with regard to it upon paper: it was a subject which was worthy of further investigation. The connection of lactic acid with rheumatism was well known, and there was no doubt that this acid had a most injurious effect on the teeth of young children. The milk that was doled out over large cities was generally in a state of incipient decomposition; it contained lactic acid, and the presence of this in the mouth, and in the blood of young children who were fed on such milk, had a great and most injurious effect upon their teeth.

His description of the Kostruma people had been criticised. He had said they were edentulous, whilst it appeared they had a few teeth. Well, if it was said that a man was bald, that did not mean that he had not a hair on his head; and similarly it might be said that these men were practically edentulous, for the few teeth they had could not have been of any use to them.

As to the remarks which Mr. Coles had dignified with the title of "theology," they had nothing to do with the purpose of the paper. And yet did it not commend itself to our sense of justice that if children suffered pain the father who had caused them to suffer should be punished for it? Was not this even the law of the world, and was it credible that the laws of Him who made the world would be less just than

ours? At all events, for his own part he was content to believe that in such cases the children would be compensated and the parent punished; and as this could not come to pass in this world it must follow in the next.

He thanked Mr. Woodhouse for his illustrative cases, which were very much to the point. There could be no doubt that the prevalence of caries was very intimately connected with the character of the food which we eat. If, for instance, children did not get a sufficient amount of phosphates with their food they could not have good teeth. There could be no doubt also that much might be done by early treatment to counteract the results of hereditary tendencies, and this fact should always be impressed upon the parents in cases where such tendencies were very apparent. Of course in the case of syphilis it was not always desirable to tell the mother that the child had this disease, but it was easy to say that the child had *a* constitutional tendency which required to be counteracted.

Mr. Sewill had said there was no mystery about dental diseases. What, then, was toothache? It was all very well to say that the pain was due to pressure on the tooth pulp; but why, when a particular cell is pressed upon, should we suffer pain, and yet when a hair was pressed suffer no pain? It was all very well to make use of certain terms and think that they explained everything; in reality we could no more explain the cause of toothache than we could explain how it was that a grain of wheat, if put into the ground, would produce wheat again.

He quite agreed with Mr. Sewill that it was important not to mix up predisposing and exciting causes, and he did not think he had done so.

Mr. Hutchinson had accused him of overlooking the differences in structure and origin of the bones and teeth. But he (Dr. Carpenter) had carefully pointed out this difference in the paper. He had dwelt upon the fact that the teeth were epithelial appendages, and that from their epithelial origin arose their liability to certain diseases. Objection had been made to his use of the term "excretory organs" as

applied to the teeth; but the teeth were excretions, just as the hair and nails were: that these latter were excretions would be readily admitted. An excretion might not necessarily be altogether useless and waste matter, but it was material that would be useless and even poisonous if retained in the body. It was his opinion that phosphate of lime was an excretion, for he found it to be such in other forms of animal life.

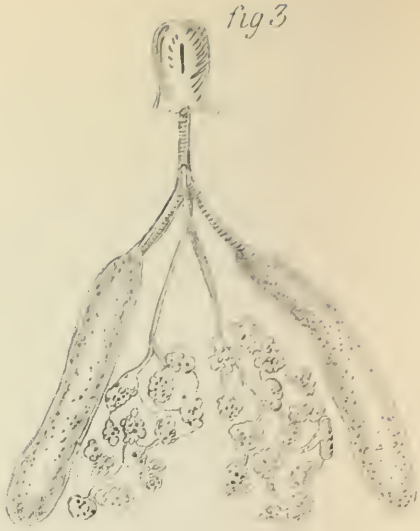
With regard to Mr. Redman's remarks about caries and vaccination, he had no hesitation in saying that vaccination had no more to do with disease of the teeth than measles had, and far less than was produced by scarlet fever. This latter disease certainly did affect the teeth, which, after a severe attack, would sometimes become loose and fall out. But then, as was well known, scarlet fever had a marked effect upon the skin and hair: the one peeled and the other generally came off more or less. And it might be said generally that whatever acted injuriously upon the skin and hair would also affect the teeth. Eruptive diseases did so, but the effect of vaccination in that direction was very limited.

He was sorry he had not made his description of the soft porous dentine which was found in the teeth of delicate children clear to Mr. Hutchinson. He could only repeat that it appeared to be due to the fact that some portion of the original protoplasm of the tooth was deficient in vitality. This, in its turn, produced defective cells—perhaps only a single defective cell here and there, or groups of such cells, —and these, instead of becoming calcified, underwent fatty degeneration. This process was not peculiar to the teeth: fatty degeneration took place sooner or later in any cell which was not fully developed, no matter where it might be situated. Thus a similar train of events might occur in the skin, or in any organ of the body, as in the brain, and wherever it occurred the result was an organ weakened and imperfect in proportion to the amount and extent of this fatty degeneration.

He had to thank some of the other speakers for the support

they had given to the propositions in his paper, especially to those who had pointed out the connection between the work of the dentist and the treatment of dyspepsia. And, in conclusion, he would express a hope that he might possibly at some future time have an opportunity of entering more fully into one or two of the more important questions which on this occasion he had merely touched upon.

The PRESIDENT then called upon Mr. Charters White to read his paper on "The Salivary Glands of Insects."



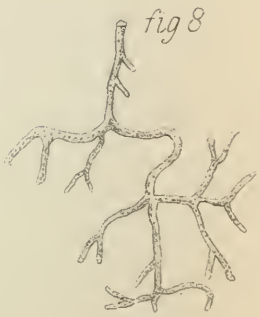


Fig. 1. Salivary glands of Blow-fly.
" 2. Do. of Flea.
" 3. Do. of Cockroach.
Fig. 4. Salivary glands of Reduvius.
" 5. Do. of Locusta viridissima.
" 6. Do. of Tabanus.
Fig. 7. Salivary glands of Cicada.
" 8. Do. of Blaps mortisaga.

The Salivary Glands of Insects.

By T. Charters White, M.R.C.S., and L.D.S.Eng.

So many papers on subjects appertaining to our branch of surgical science have been brought at various times under your notice, and have been so fully and carefully treated, that those who come after find not only great difficulty in choosing a theme that has not been well-nigh worn threadbare, but have often felt compelled to go out of the rightful and legitimate domain of dental surgery, and to enter on that of dental mechanics, to find a theme upon which to base their thesis. I am in that position to-night: every branch of our special department has been fully worked out in previous papers, our every-day treatment of those diseases of the mouth which are our peculiar care has been discussed at our meetings and improved for the general good, and I therefore find the ground cut away from under my feet by those pioneers who have gone before. In these days of hard work it is not easy to find the time necessary for original research; that must be left

to the younger and more vigorous members of our fraternity, those who have the time, the talent, and the opportunity. While bearing in mind that this is a society taking especial cognizance of the oral anatomy and physiology of the human subject, I ask your permission, in the absence of more important matter, to bring under your notice one or two of those instances in comparative anatomy which, while not bearing directly on our daily duties, should possess an interest for every intelligent practitioner of our art.

I have placed under my microscope this evening the salivary glands of the cockroach (*Blatta orientalis*), a creature whose abundance as an inhabitant of our metropolitan kitchens affords every facility for investigation, and of which opportunity I have not been slow in availing myself. It is my wish to call your attention to one or two details in reference to the anatomy of these glands, and to take a passing glance at two other types readily presenting themselves for examination without much trouble. Time will not allow of an exhaustive treatment of the glands of insects generally, but after having seen those brought under notice this evening, I hope it may tempt my younger brethren to tap the source of an infinite variety which cannot become stale by closer contact with it.

Before entering upon a consideration of this highly interesting subject, I would call back to

your minds, if needful, the general plan on which the salivary glands are constructed, the use of the saliva in the preparation and assimilation of the food, the forms of some of the salivary glands met with in insects, and finally describe the complex yet beautiful arrangements in the salivary glands of the cockroach.

In the formation of a secreting gland the first element necessary to the proper performance of its function is that there should be a free surface from which the secretion can be discharged, and in the next place the blood from which the secretion is eliminated should be brought into intimate contact with this surface : these are the primary factors which, through the medium of the secreting cells, perform the process of secretion; all the remaining forms and conditions are as mere adjuncts. This arrangement may be observed in its greatest simplicity in the secreting surfaces of the body, the mucous, serous, and cutaneous surfaces furnishing well-known examples ; but when it is necessary to condense a secreting surface, then it is we meet with those various forms of glands providing a large surface if expanded, but occupying a contracted area in the situation in which they are required, and where an extended surface would be inadmissible. This condition gives rise to great variability in the forms of glands ; this variation of the shapes of salivary glands would furnish suffi-

cient material for a very long paper, but I can only briefly indicate a few of the types of the general arrangement of them in the insect world, leaving it to others to work out more fully this almost inexhaustible mine of anatomical wealth. In departing from the plain secreting surface, nature adopts various expedients for getting this increase of surface with the least encroachments on space, retaining the efficiency of the glandular function while concentrating the dimensions of the gland, and in doing so presents two methods, one being the protrusion of glandular processes from the surface, the other by an inversion of the secreting surface. As examples of the first method I may quote the synovial fringes of the knee-joint, which secrete the fluid, the choroid plexuses of the brain, and other such like instances met with in the animal structure ; but they are not so numerous as the second modification, that by inversion : this may be met with in every degree, from simple inverted tubes, or follicles, such as abundantly stud the mucous membrane of the stomach and intestines, to the elaborate racemose glands of the parotid and pancreas. Passing by the part played by the secreting cells in the function of salivary secretion, which is well known to you all, and bears more on the physiological aspect of this subject than on its anatomical, I may just say that the salivary secretion is a fluid of some complexity,

whose principal and most important constituent is, as you are all aware, a substance termed ptyaline, a substance which possesses the property of converting innutritious into nutritious food ; you are well acquainted with one of these properties, that of converting starchy materials, which of themselves are innutritious, into sugar which is a nutritious food : for this reason it plays a very important *rôle* in the animal economy. In the herbivorous insects we find a great development of the salivary glands, while in the carnivorous they are comparatively insignificant; but the saliva has also another office to perform, that of supplying solvents for moistening and softening food, and it will be as well to bear these two points in mind in the examination of the salivary glands under notice this evening. In no class of animal life can the advantages of concentrating an extended secreting surface within a small compass be better seen than in the insecta: for in them, the principal part of the thorax being occupied by the muscles of locomotion, very limited space is allotted to these necessary organs of digestion ; hence we find the salivary glands of various shapes and dimensions so disposed that they fit in with, without obtruding on, the other thoracic contents ; indeed, their intermingling offers one of the greatest obstructions to a clean and perfect dissection of them. The salivary glands of the insecta may be divided

into three groups, each possessing distinctive characteristics: first, those which are tubular—these may be subdivided into the long and convoluted tubes of flies and lepidoptera, the branching tubes having blind extremities, as found in *Blaps mortisaga*,—the churchyard beetle, and the tubes surrounded at intervals by whorls of cœcal bags, as in *Cicada*; the second group comprises that variety of form which is represented by the gland of the cockroach, viz., the racemose gland, which finds its simplest form in *Gryllus domesticus*; the third division may be called the cystic, consisting of mere globular distensions of a secreting tube, and finding its representatives in *Pulex irritans* and *Cimex*. By referring to the rough diagrams exhibited, the principal types will be made more evident. As the salivary glands of the mammalia open by ducts into the mouth, it might be reasonably inferred that they do so in other animals, seeing that one of the offices of the saliva is the moistening and softening of the food previous to deglutition; but while they do in insects, as a rule, open on the floor of the mouth, a large number of instances occur where they occupy positions much lower in the alimentary canal. Again, they differ in number in many insects, the majority having only a pair, while others have two or even three pairs uniting their tubes to form a common duct. In *Nepa cinerea*, or water scorpion,

which has three pairs of glands, two unite on each side to form one duct, while the third pair remain distinct till it reaches the mouth, and is considered by some insect anatomists to be a poison-secreting gland, which may be the case, as *Nepa* is well known as one of the most predaceous inhabitants of our freshwater ponds. Again, they may vary in length in different insects, being in some cases, particularly in larval forms, and especially in caterpillars, as much as two or three times the length of the intestine, and as the progressive development and growth of these larval forms presupposes the need for an increased proportion of nutrition, we may explain the necessity for such extensive salivary glands on the ground of an increased demand for ptyaline to promote the assimilation of the enormous quantity of vegetable food they consume; in perfect insects, with perhaps the exception of the fly, they do not extend beyond the thorax. Burmeister, to whom I am indebted for some of my information, divides the salivary glands of insects into those opening into the mouth, and those situated in close proximity to the stomach, and opening more or less directly into it; the large aquatic beetle, *Dyticus marginalis*, offers a very good example of this latter division, the whole of the external surface of the stomach being clothed with cœcal tubes, which open on its interior and help to make up its lining surface, and

are said to secrete saliva. The same peculiarity may be met with in many of the carnivorous beetles, and grave doubt is thrown by many observers on their salivary function, being considered more properly glands for the secretion of gastric juice; but whatever their true office, the histological student will find them most interesting objects when stained with carmine, which will bring out the large nucleated secreting cells which line their interior. As I wish to confine my remarks to those insects whose salivary glands open into the oral cavity, I shall leave these doubtful glands out of consideration, and pass on to examine the anatomical character of the three groups which stand most prominently before us. I have said that the salivary glands of insects may be divided into three groups—the tubular, the racemose, and the cystic, and if I give you an illustration out of each of these, it will enable you to examine the rather imperfect specimens I have placed under the microscopes on the table with a better chance of understanding them.

The first to which I shall call your attention is that simple form of tube which, although found in many insects modified in arrangement, such as the branched tube with blind extremities in *Blaps* (fig. 8), or the distended tube of *Tabanus* (fig. 6), finds its simplest example in *Musca vomitoria*. In the blowfly the salivary glands are found

lying as convoluted tubes, one on either side of the chyle stomach in the thorax, but are attached so intricately by the tracheæ to adjacent organs that it is a work of much difficulty to isolate them in dissection without tearing and damaging them; near the anterior portion of the thorax the glandular tube opens out into a sacculus, which, becoming gradually contracted to form the duct, passes onwards to join its fellow of the opposite side, when the duct becomes common, and opens by a narrow slit on the upper surface of the labium which forms the floor of the mouth. Mr. B. T. Lowne, who has made some most delicate and careful dissections of the blowfly, so accurately describes the anatomy of this part that I am sure you will forgive my introducing his clear and lucid description of it; he says: "The salivary ducts and common salivary duct are kept open by a spiral fibre developed in their internal coat. The external coat is yellowish, thick, and thrown into rugæ except when the ducts are stretched. The ducts are exceedingly elastic and extensile; just above the labium the common duct changes its character, losing its spiral fibre and extensibility. It becomes perfectly transparent, and dilates into a cavity somewhat resembling the human glottis. This is a most perfect valve, for its superior wall is elastic, and pressed down at its anterior portion against the inferior wall, so entirely closing the

duct at this point. A pair of long slender muscles arising at the posterior extremity of the pharynx, run beneath that organ, and are inserted into the anterior part of this valve, opening it by their contraction. It will be easily understood that the sucker-like action of the lobes of the proboscis, as well as the opening of the pharyngeal cavity, would tend to exhaust the mouth of air, and so to cause a flow of salivary fluid into its cavity, which would continue as long as the proboscis remained in action, were it not for this valvular arrangement in the salivary duct. The opening and shutting of the valve is controlled by a ganglion placed in front of and beneath it ; nerves from this ganglion are distributed to the mouth, as well as to the long muscles which act upon the valve. Any dryness of the epithelial lining of the mouth in which these nerves ramify would undoubtedly communicate an impression, and cause a reflex act by which the valve muscles would contract and so cause a flow of saliva by opening the valve." I have thus quoted at some length from Mr. Lownes' "Monograph on the Anatomy of the Blowfly," because its description is so clear, and the explanation so ingenious; I have the less hesitation in doing so because I can, from my own dissections, verify all that he has stated. A specimen placed under the microscope on the table and the photograph I hand round

showing the valve and the two muscles attached to it.

Very different in their characters are the salivary glands of the flea (fig. 2), which may be also examined under the microscope after the close of this meeting.

These glands commence as two bladders lined by very minute secreting cells; these, with two similar bladders, are attached on either side of the proventriculus, or crop; from these two bladders, situate in the anterior part of the thorax, two short tubes, continuous with the interior of the glands, and distended by a spiral fibre, pass off and become united, passing thence as a single tube to join the corresponding tube of the other side, where they form the common duct which enters the oral region. As the oral cavity of *Pulex irritans* is so small, it strikes one as being somewhat difficult, if not impossible, that blood corpuscles should find their way through it, and as they are never found in their entirety in the red food contained in the crop, it is just possible that the salivary secretions may act upon the corpuscles as powerful solvents, thus enabling them to pass in a fluid form; probably these secretions may be of an acid character, but of whatever nature they may be, they evidently possess a constituent of some corrosive power, for we have experience of the irritability remaining

after the puncture of either *Pulex irritans* or *Acanthia lectularia*. The saliva of a serpent, it is stated, has a powerfully solvent action, and if such is the fact, we may find an analogous instance in this case of the purely carnivorous flea possessing salivary glands fitted to supply a solvent for their food.

These glands appear, in form, to occupy an intermediate position between the tubular glands, as, for instance, those of the fly, and that which I shall next bring under your notice in the salivary glands of the *Blatta orientalis* (fig 3).

Secreting glands are sometimes provided with reservoirs, in which the secretion is stored till it is required to be used or got rid of: thus the kidneys store their secretion in the bladder, the gall bladder receives the bile, the vesiculæ seminales may also be quoted as receivers of glandular secretion; but in no case do we find storage provided for the saliva amongst the higher animals, if we except the snakes and the so-called storage of poison, but the saliva is being swallowed as fast as secreted; but in the cockroach sacs are attached to the salivary glands, and are found very frequently distended to their utmost extent by a clear, colourless fluid of a slightly acid reaction when tested with blue litmus paper.

It is this peculiarity of storage which adds an interest to the salivary glands of this member of

the *Blattidæ*. I may perhaps make my description more lucid if I describe the appearances of them presented on dissection. In dissecting a cockroach, the easiest plan of proceeding, after chloroforming it to death, is to remove the legs and wings, close up to the thorax, by a fine pair of scissors; then pin it down to a cake of wax under water, to which a little spirits of wine has been added; then with the scissors cut an incision up each side of the thorax, without greatly disturbing the thoracic contents, carrying the incision up to and partly into the occipital foramen; raise the whole of this flap, taking care to clear it of the tracheal attachments as you proceed; when you have reached the foramen cut off this chitinous flap; the thoracic contents then presented to your notice will probably be, first, the proventriculus slightly distended with fluid: examining this with a hand lens you will observe, on either side of it, a racemose body, looking very silvery from the presence of an extensive ramification of tracheæ, which not only permeate the glandular structure dipping down between the secreting cells, but bind the entire organs to the sides of the crop—these glandular lobules, looking like a flattened bunch of grapes, bear a striking resemblance to the similar racemes of the parotid in the higher animals: the lobules are more or less three-sided, and made up of a multitude of saccules,

united by a connective tissue, and emptying their contents into tubes which, uniting with each other, become an excretory duct of some considerable size, which passing upwards joins with the corresponding duct of the other side, becoming a common duct, opening in the floor of the mouth ; further examination will show that, after these tubes have united, two other tubes join the common duct, and on tracing these back we find each tube ending in a long sac of very extensile tissue, lined with pavement epithelium, having large and well-marked nuclei, and if the insect has been recently caught, these sacs will be found flaccid and empty, but if it is kept without food for some time, and there has been no demand for saliva, these sacs may be seen as clear distended bladders, unless, as often happens, they get accidentally ruptured in dissection. The cricket has a somewhat similar arrangement of its salivary glands, but of a much more simple character. I have not been able to make out the existence of these sacs in this insect, but judging from the starchy nature of the food taken by these denizens of our metropolitan bakeries and kitchens, I should surmise that the cricket possessed them equally with the cockroach, and that careful dissection would find these necessary addenda to the salivary glands.

In the higher animals the salivary glands are thoroughly permeated by the capillaries, but in

the insecta the blood circulates through *sinuses* whose walls are made up by the various viscera, and which are thus constantly being bathed by it, and in this manner the salivary glands of insects are enabled to select from it, and to appropriate those constituents necessary to the production of saliva; no more suitable form to furnish such an extended surface to this circulatory fluid could be conceived than the flattened racemose condition of these glands in the cockroach. Having selected their salivary nutrition for the blood, it undergoes its modification in the secreting cells, and the product is then collected in a simple ramification of the duct which, by careful observation, may be traced into each lobule. The secretion then accumulates as the contents of each lobule is poured into the main duct, and at last it reaches the common duct, where, if no necessity for its expenditure exists, it is stored in the salivary sacs.

In taking a general view of the salivary glands of insects, we find that while they exist in their simplest forms in the carnivorous class, such as the flea, the gadfly, and the predaceous water-beetles, and passing through that class which contains the omnivorous fly, with its simple, if extended, tube, we touch upon the elaborate gland when we come to those insects whose food, being the farthest removed from the purely animal, and

therefore more difficult to assimilate, necessitates the provision of an abundant supply of ptyaline to convert, by its catalytic action, the starchy elements into the sugar of nutrition; that this salivary secretion has a most powerful effect upon the food of insects may be proved by observing the change in character which occurs in a mulberry-leaf, during the process of its mastication by a silkworm: it is roughly cut off and quickly chewed, at the same time mixed with the saliva, which produces an appearance in it as if the leaf had been boiled, and thus the green pap is conveyed to the stomach in a fitter condition to undergo its conversion into chyme. It would be an exceedingly interesting study, if one had the time, the hand, and the eyesight, and would at the same time supply a hiatus in insect anatomy, if the salivary glands of insects and their larvæ could be worked out fully; in this small contribution to the subject which I have been enabled to offer I have derived much interest, and a clearer insight into the beauty of insect organisation than would be generally imagined, and, at the same time, the training of the hand for gently and steadily touching delicate mouths is not the least of the advantages to be derived from a prosecution of these researches. I fear I have dealt rather too concisely with my subject, but it will allow more time to be devoted to the

very instructive examples of these three types which I am enabled to show you under the microscopes.

Discussion.

At the conclusion of the paper, which was illustrated by diagrams, and by drawings and photographs of miscroscopic specimens, these latter being also arranged under microscopes ready for examination at the close of the meeting, the President remarked that Mr. White's paper was a communication of great value and interest, but it was one which they were scarcely competent to discuss, even if they had time. And as they had already exceeded the time usually allotted to the meetings, he would at once propose that the thanks of the Society be given to Mr. White for his paper, to Messrs. Brunton, Parkinson, Redman, and the other contributors of the evening, and especially to Dr. Carpenter, who by attending a second time, at considerable personal inconvenience, had shown the great interest he took in the advancement of dental science.

(The meeting was then adjourned.)

Odontological Society of Great Britain.

ANNUAL GENERAL MEETING.

January 8th, 1883.

S. LEE RYMER, Esq., President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

The President declared the ballot open for the election of officers and councillors for the ensuing year.

Messrs. R. Woodhouse and A. Swanson were selected in the usual way to act as scrutineers of the ballot.

The President announced that the following gentlemen had been duly nominated as candidates for election, and would be balloted for at a subsequent meeting, viz.:—

Messrs. Thos. C. Stellwagen, M.D., D.D.S., of Chestnut Street, Philadelphia, Professor of Operative Dentistry at the Philadelphia Dental College (proposed by the Council for election as a Corresponding Member).

W. R. Humby, L.D.S.Eng., 88, Newgate Street, E.C.

John Faulkner, L.D.S.I., 22, Old Burlington Street, W.

William Hern, M.R.C.S. and L.D.S.Eng., 32, Oxford Road, Kilburn.

The following candidates were then balloted for and elected members of the Society:—

Messrs. Bentley J. Bonnell, 94, Cornwall Gardens, South Kensington, as a Resident Member, and

Jas. Grant, of St. Heliers, Jersey, as a Non-resident Member.

Mr. S. J. Hutchinson showed a model of the mouth of the girl now being exhibited at the Westminster Aquarium as "The Missing Link." She was said to be "about seven years old," and if judged by her appearance and remarkable intelligence would be thought to be considerably older; but an examination of her mouth showed that she had not yet cut her six-year-old molars. The four upper temporary incisors were decayed, and the permanent centrals were just coming through behind them; the six-year-old molars in the lower jaw were apparently on the point of eruption. The child was remarkably hairy: her arms and legs were covered with fine silky hair, at least an inch and a half long, whilst her forehead down to the eyebrows presented a thick crop of short bristly black hair. She was said to possess a rudimentary tail, but this he (Mr. Hutchinson) did not specially investigate. As he had already stated, she was very intelligent, and it was a remarkable fact that the measurement across the top of her head from one ear to the other was about 3 inches more than the average of English children of the same age. Dr. Carpenter, in the paper he had lately read before the Society, quoted Darwin's theory that there was a correlation between the growth of the hair and of the teeth—that when the one was in excess the other was deficient. This assumption was founded on the case of the Kostroma people, who were hairy and almost edentulous; but the present case did not support this theory, for, though the child was hairy, her dentition up to the present was normal He might add that the child's father exhibited the same peculiarities, and would have been shown with her, but died whilst on his way to this country.

Mr. Coleman said that at the last meeting he had mentioned a case of very early eruption of the permanent teeth; he would now bring forward a case of the opposite kind. He had lately seen a girl, ten years of age, who had only erupted one permanent molar, and in whom the lateral incisors were wanting in both jaws. Another child in the same family, five years of age, had no lateral incisors and no first temporary molars; the lower central incisors also were rudimentary. Their grandmother and her brother had a deficiency of the lateral incisors. In the case of the child first mentioned it was impossible to say as yet whether the molar which had appeared was a six-year-old tooth, or a second molar which had come through before its time, the first being absent. The dental arch was well formed. There was in this case no excess of hair to balance the deficiency of teeth.

Mr. J. S. Turner showed an ingeniously constructed wire frame for stretching the rubber dam, obviating the necessity for using back weights. It had been sent him by Mr. Fernald, of Cheltenham; he (Mr. Turner) had tried it and found that it answered its purpose exceedingly well.

Mr. Stocken showed, under the microscope, a portion of tooth pulp entirely disorganised and studded with masses of calcification. There was only superficial decay of the tooth, but the patient had suffered for a long time from very severe attacks of neuralgia.

Mr. Vanderpant showed a model of the mouth of a lady who had retained her upper temporary incisors to the age of thirty. So much inconvenience was caused by the front teeth not meeting, that he was induced to extract the temporary teeth and insert a partial denture.

Mr. Chas. Tomes said as the time set apart for casual communications had not quite expired, he would mention a case which presented some points of interest. A boy, eleven years of age, about a year ago knocked out one of his central incisors. The accident happened early in the morning; the boy picked up the tooth, and carried it in his pocket all day. It was

late in the day when he was brought to Mr. Tomes by his parents. The tooth was grimed with dirt, so he washed it well in carbolised water, then enlarged the apical foramen slightly and extracted the pulp, which came out entire. He then filled the pulp cavity and canal with gold, and replaced the tooth, securing it in place with a gutta-percha splint; there was tenderness for a few days, but this soon subsided and the tooth became quite firm. Mr. Tomes had seen the patient only a few days since; the replanted tooth appeared to be as firmly fixed as any of its neighbours, but Mr. Tomes was surprised to see that it had acquired the dusky discoloration ordinarily seen in a dead tooth: although the pulp had been removed entire, and the apical foramen securely closed, yet by some means or other the dentine had become stained.

The PRESIDENT then called upon Mr. Coleman to propose the alteration in Bye-law XVIII, of which notice had been given.

MR. COLEMAN said it would not be necessary for him to take up much time in explaining the objects of the proposed alteration. It would be obvious that it was very desirable that the Editor of the Society's Transactions should have a seat at the Council, in order that he might be able at any time to give information, or take part in any discussions with reference to the publication over which he presided. Hitherto the duties of Editor had been undertaken by a member of the Council, but it was felt that it might be desirable to have a wider field for selection, and the proposed alteration would enable the Council to choose an Editor from amongst the whole body of the members, and the gentleman so selected would then, by virtue of his office, become a member of the Council. He would therefore propose that in Bye-law XVIII, after the words "Curator of the Museum *ex officio*," the words "and the Editor of the Society's Transactions *ex officio*" be inserted.

MR. PARKINSON said that after the explanation which had been given by Mr. Coleman of the nature of the proposed

alteration, he need do no more than formally second it. It was, no doubt, desirable to give as wide a choice as possible in the selection of so important an officer as the Editor of the "Transactions," and as their present worthy Editor was about to be raised to a higher office, this seemed to be a good opportunity for making the alteration.

The motion was then put from the chair, and unanimously agreed to.

FINANCIAL STATEMENT.

The PRESIDENT having called upon the Treasurer for his report,

MR. PARKINSON said the receipts for the year 1881–2 amounted to the sum of £559 14*s.* 10*d.*, and the disbursements to £440 13*s.* 4*d.*, leaving a balance of £119 1*s.* 6*d.* Amongst the receipts, the amount received for entrance fees was nearly £50; he anticipated that the Qualification Law, which had just come into operation, would diminish this source of income considerably for some years to come. During the year there had been 13 resignations—4 resident and 9 non-resident members; 8 deaths, viz., 2 resident, 2 non-resident, and 4 honorary members; 21 new members had been elected, 10 resident and 11 non-resident, besides one honorary member; 12 names had been removed from the list of members, owing to non-payment of subscriptions, viz., those of 2 resident and 10 non-resident members. The Society now consisted of 128 resident, 209 non-resident, and 43 honorary and corresponding members. (A detailed statement of accounts is subjoined.)

The Treasurer in Account with THE ODONTOLOGICAL SOCIETY OF GREAT BRITAIN,

for the Session ending 31st October, 1882.

DR.	£	*s.*	*d.*
To Balance at Bank, and in Treasurer's hands, 31st October, 1881	378	17	4
Annual Subscriptions	393	3	0
Entrance Fees	48	6	0
Arrears of Subscriptions	48	6	0
Sale of "Transactions"	16	5	7
Dividends on Stock	36	14	3
Interest on Deposits	17	0	0
	£938	12	2
ASSETS, 31st OCTOBER, 1882.			
Stock (in New Three Per Cents.)	1,262	18	8
Cash at Interest	550	0	0
Cash at Bank and in Treasurer's Hands	461	10	6
	£2,274	9	2

CR.	£	*s.*	*d.*
By Printing and Publishing the "Transactions," Reporting, &c.	121	9	5
Rent (one year)	80	0	0
Refreshments	25	16	0
Museum	51	18	0
Library	41	4	2
Postage and Receipt Stamps	19	16	0
Sundries	45	11	6
Purchase of Stock	36	14	3
Amount of Stock Invested, overstated 31st October, 1881	18	4	0
	£440	13	4
Receipts	559	14	10
Disbursements	440	13	4
Surplus	119	1	6

Mr. Felix Weiss said he was pleased to be able to report that, owing to the liberality of the Council, a considerable addition had been made to the library during the past year. 69 works (exclusive of periodicals) had been purchased, viz., 43 English, 12 American, 11 French, 2 German, and 1 in Latin. Some of these had been included in an Appendix to the Catalogue, of which a copy had been sent to all the members. The books were all in a good state of preservation, and had been borrowed by the members in larger numbers than in any previous year, no less than 38 members having availed themselves of this privilege. The number of students making use of the library had not been quite as large as during the preceding year, but he had every reason to believe that their endeavours to make their collection the most complete dental library in the world was thoroughly appreciated by both members and students.

He had been requested to mention that members, and more particularly students, were not allowed to transfer books from one to another. He had found out that this had been a common practice during the past year; but it was objectionable, not only because it became difficult to ascertain the whereabouts of a book when wanted, but also rendered it less easy to detect the guilty party in case of the loss or injury of a volume.

The Curator (Mr. S. J. Hutchinson) reported that since the issue of the catalogue last year, between twenty and thirty specimens had been added to the museum. Of these three of the most important had been sent from India, by Mr. O'Meara. He would take advantage of the opportunity to call upon the members to do what they could to improve their museum of comparative anatomy. Their collection of anatomical and pathological specimens was good, but that relating to comparative anatomy was very imperfect. He was sorry to say that there were a few omissions in the catalogue issued last year, and these, with the new specimens, would be embodied in a supplement, which he hoped would be ready before the next meeting.

The Scrutineers announced that the following list of office-bearers, recommended by the Council, had been duly elected.

List of Officers and Council for the Year 1883.

President.

Dr. Joseph Walker.

Vice-Presidents.

Resident, Messrs. Chas. S. Tomes, Henry Moon, and T. Charters White.

Non-resident, Messrs. Walter Campbell (Dundee), Wm. Doherty (Dublin), and J. T. Browne-Mason (Exeter).

Treasurer.

James Parkinson, Esq.

Librarian.

Felix Weiss, Esq.

Curator.

S. J. Hutchinson, Esq.

Honorary Secretaries.

Messrs. T. F. Ken Underwood (*Council*), J. H. Mummery (*Society*), and Claude Rogers (*Foreign Correspondence*).

Councillors.

Resident, Messrs. Alfred Coleman, J. Stocken, Isidor Lyons, G. A. Ibbetson, Ashley Gibbings, Thomas A. Rogers, J. S. Turner, F. Canton, and Alex. Cartwright.

Non-resident, Messrs. William Fothergill (Darlington), Martin Magor (Penzance), R. Rogers (Cheltenham), W. Heb (Carlisle), A. Wilson (Edinburgh), and R. White (Norwich).

The President then proceeded to deliver his valedictory address.

PRESIDENT'S ADDRESS.

Gentlemen,

In vacating this post of honour, allow me to address you in reference to a few points which appear to be of particular interest on such an occasion.

The year which has just closed upon us can scarcely be said to have been conspicuous for great or startling events in the history of our Society, although it has certainly witnessed steady and useful work, well calculated to speed on the supreme object of our existence as a Society, namely, the enlargement of technical knowledge—which means the elucidation of truth.

But before glancing at the several items which have engaged the attention of our monthly meetings, I must congratulate you upon the official reports which have this evening been presented. The Treasurer's report, perhaps, exhibits most certainly the prosperity or otherwise of our position year by year, and having regard to its significance in this respect, I think his lucid statement of accounts for the last twelve months may be regarded as entirely satisfactory, and as denoting a sound condition of affairs.

The Librarian and the Curator have informed you that the respective departments under their management have received numerous additions. The carefully compiled supplemental catalogue of the library issued in June last furnishes a desideratum which had been for some time felt: we are much indebted to the gentlemen who have watched over and so well maintained the efficiency of the library and museum, —the catalogue of the contents of the latter, I may say in passing—to which just and graceful allusion was made by my predecessor in office a year ago—has since been delivered

to the members, by whom, I am sure, its merits are deservedly appreciated.

To the Editor of the "Transactions" acknowledgments are due for the attention given to the issue of the publication of our proceedings month by month. The task is much more easy to criticise than to fulfil. I confess that before I had sufficient opportunity of becoming acquainted with the difficulties of the position, I sometimes felt that the appearance of the "Transactions" was unduly delayed; but a better knowledge of facts has taught me that so far from this being the Editor's fault, it has been to him a source of considerable anxiety and annoyance. Papers and communications, for the sake of exactness, are, according to the system at present adopted, sent in proof to their authors, with the request that the same may be corrected and immediately returned. From accident or inadvertence, serious delay often occurs before the proof is received back; hence inevitable loss of time. It may be worth considering as to whether the system cannot be amended, so that it shall be understood that proofs must be returned by a certain fixed date, unless the authors are content to accede to the revision of the Editor alone. In this way the "Transactions" could be delivered within ten days or a fortnight of each meeting, thus being in the hands of members with something like freshness, and the notices in advance, on the cover, would be so in fact, and not reach the eye after the occurrence of the events indicated. Interest in the proceedings of the Society must necessarily depend, to a considerable extent, upon the manner in which they are reported and distributed. In themselves I contend that the reports have been excellent, but as I have ventured to hint, the period of issue is capable of improvement.

The importance of the Editorial position has been realised by the Council, and as our late Editor was likely to be elevated to the highest position, it was considered a convenient opportunity to recommend the Society to create a

new office in the election of an Editor, who should, by virtue of such office, be entitled to a seat at the Council Board. This recommendation has now been formally agreed to, and I have no doubt that its adoption will be attended with good results.

Whilst upon the subject I may mention that the Council have arranged that, commencing with the current volume, the "Transactions" shall be presented to our honorary and corresponding members. This course will, I think, commend itself to the Society as a compliment justly due to those whose services to our special branch of science have led to their names being inscribed upon our Honour List. It will also prove the means of regular communication with these distinguished gentlemen, resulting, as we may well hope, in more frequent personal intercourse between them and the general body.

The death-roll of the year, happily, numbers few names, although representing men of high repute. In the loss of Mr. Clover, the eminent anæsthetist, a universal feeling of regret was experienced, and in that of Mr. Canton the Society has been obliged to part with one to whom it was very deeply indebted for unwearied exertions on its behalf for many years —commencing with its foundation. Mr. South has also, unhappily, passed away. These gentlemen were honorary members at the period of their lamented decease, when the Society passed fitting resolutions of regret, and also of condolence with their respective families.

Mr. Tucker, of Boston, a corresponding member, must be, I am sorry to say, added to the list. Besides these gentlemen we have also to deplore the loss of Dr. Roberts, a late vice-president of the Society, of Mr. Clement, of Bayswater, and of Mr. Heath, of Richmond.

Although, as already observed, the year may not have been productive of particularly extraordinary events, there is one of historical importance to us, which needs reference—I mean

the consummation of the law of qualification, which has been in contemplation for so many years, and which, after most careful and exhaustive thought and discussion, came into force on the 1st of November. No one can, in this matter, properly accuse the Society of illiberality towards worthy men practising dental surgery without recognised qualifications. The doors have been freely and widely open to these as well as to diplomatised practitioners for a quarter of a century. That limit having been reached—after long notice, widely given and frequently repeated—the portals are now irrevocably closed to all but the latter, and there can be no doubt that the policy thus pursued has been generous as well as wise. From henceforth, then, the Odontological Society can only be reinforced from the ranks of men who have proved their title to scientific worth in addition to honourable social *status*.

Of the unabated interest evinced in the Society's proceedings no better proof is needed than the uniformly good attendance at the stated meetings; and I have been pleased to observe, as an encouraging sign of the times, that our junior members are coming well to the front by taking part in the deliberations, and assisting in various ways, instead of leaving almost everything to the seniors. The time thus occupied will, I hope, be regarded as having been profitably, as well as agreeably, employed.

I do not propose to detain you, gentlemen, with minute analyses of the papers and contributions of the session, because such will be fresh in your memories, and are stored for easy reference in our published records; at the same time I must not omit some mention of these valuable contributions, emanating as they have from different quarters, including this metropolis, the provinces, and the colonies, and showing, in a gratifying way, that the value of the Society is not localised in any sense, but, on the contrary, appreciated far and wide.

First let me refer to the Casual Communications. These have been varied, useful, and interesting. Information conveyed in this succinct form is generally of considerable value, and tends, moreover, to relieve any tedium which might arise from a consideration of extended scientific papers, given in unbroken series.

Referring to the papers of the session, it seems superfluous in me to remind you that we have had the pleasure and advantage of listening to some extremely instructive and suggestive addresses. In these Mr. Coffin, whose attention has been long and intelligently directed towards the correction of irregularity in children's teeth, informed the Society very clearly as to his plan of obtaining correct impressions for regulative arrangements.

Mr. Hunt, of Yeovil, in a paper of practical aim, demonstrated the perfection to which the beautiful material known as "celluloid" could be adapted to artificial dentures by means of a new apparatus devised by Dr. Campbell, who had, at a previous meeting, exhibited the machine referred to, and explained its operation.

From Auckland, in New Zealand, Mr. Edwin Cox addressed the Society, in a graphic paper, on a case of obscure diagnosis in the early stage, but which ultimately proved to be one of cancer of the superior maxilla, and costing the patient his life. This case is well deserving of consideration, especially in regard to the somewhat delicate subject subsequently introduced by Mr. Thomas Gaddes, and having reference to the "Limitation of Dental Surgery," a question which has also been under notice by the Odonto-Chirurgical Society in Edinburgh during the year. The discussions following on each occasion appeared to settle in one focus:—no hard and fast line could be devised; the good sense and judgment of individual practitioners would guide them in the right course. The index to our past year's volume of "Transactions" will show at a glance that *Dental Caries* has not been lost sight of

as a subject of contemplation. Mr. Steele and Dr. Carpenter have, respectively, expressed themselves thereon—the one in a short but tersely worded paper, the other in an elaborate and important address. These communications, and the discussions which followed their delivery, taken altogether, appear to strengthen the impression even still entertained by not a few practitioners—after due allowance for considerable advance in knowledge—that there is room for further investigation before the origin of this increasingly prevalent disease can be determined with complete satisfaction. Difference of opinion may not here present a very wide divergence,—

"Not so deep as a well,
Not so wide as a church-door,
But 'tis enough."

In point of scientific merit the last paper of the year—that by Mr. Charters White—must occupy a high position. In this carefully worked and beautifully illustrated communication, Mr. White enlightened us upon a subject only to be grasped by the cultivated mind of the microscopist.

Passing from this cursory review of our own proceedings, I will, if you please, refer briefly to some portion of what may be termed the "outside work" accomplished in 1882.

In our special literature, as also in science and art, progress is perceptible, although the period has been one rather of application, observation, and investigation, of which the fruits will be more fully apparent in the future, than of present outward and visible sign. Amongst the several organizations aiming at the elevation of dental surgery as a professional calling, I venture to assert that none have stronger claims upon our active sympathy and support than the British Dental Association. Of the particular objects of this Institution you are familiar; I need not therefore enlarge upon the zealous, able, and by no means unsuccessful management of affairs, dating from the period of its public inauguration,

but a few words in reference to its first general meeting in the provinces will not be out of place. It was my privilege to be present at Liverpool, in August last, on the occasion referred to, and there joining many other members of the Odontological Society. None who attended could fail to be gratified at witnessing the happy result of the proceedings throughout. I should say that the prevailing impression left upon the mind of each one would, at the close, be this, namely, that proof had been adduced of the existence of professional spirit within the Association of so vigorous a nature as to promise certain triumph in the prosecution of its objects over all obstacles. These objects being in themselves patriotic and beneficent, we may well wish the organization "God speed;" nor need we stay to inquire as to whether the reading and discussion of papers on pure science would not be better left to Societies such as ours. If time can be utilised for scientific work at these annual conventions without loss in other respects, far be it from us to feel any narrow-minded jealousy on that score; but I am very much inclined to believe that the political requirements of the near future will prove of immense importance, and that it will be necessary on the part of the Association to concentrate all available resources in their consideration. The recent appointment of a joint committee by the Colleges of Surgeons and Physicians is a step, to the dental surgeon, of interest, as the object proposed may, if carried out, influence his speciality for weal or for woe, according to the manner of its achievement.

On the whole we have no cause to complain of the professional position as we find it to-day. Sometimes, however, I fancy we are prone to cry up our own times a little too much in comparison with those which have gone before—a weakness which appears to have existed in every recorded epoch. The other day I turned over the leaves of an old and neglected book on surgery, long in my possession, and was surprised at the advanced intelligence of the author.

The book is entitled, "A Course of Chirurgical Operations, demonstrated in the Royal Garden at Paris, by Monsieur Dionis, Chief Chirurgeon to the late Dauphiness and to the present Duchess of Burgundy." It is an English translation of the Paris edition, and reprinted in London in 1710.

The nature of the contents (bearing in mind the date of issue) indicates remarkably advanced views in regard to surgical operations, including those of dental surgery. Deeming this old book of sufficient attraction to be placed in our library, I shall have pleasure in presenting it thereto, but I may in the meantime observe that the "Demonstrations" it includes were given nearly 200 years back. Mr. Weiss has within the last few days published some interesting remarks upon dental surgery 100 years ago, which go far to prove that our French neighbours were more enlightened upon the subject than ourselves at a date anterior and comparatively remote to that quoted by Mr. Weiss.

A perusal of Dionis's work shows the author to have been a man of high professional honour, as well as of keen perception. His teaching and practice were founded upon scientific knowledge and experience of no mean order, and his efforts were directed towards a more complete study of anatomy than prevailed in his day, amongst men preparing for the practice of surgery, so that the art should in the future be exercised dexterously according to the light of science. In his preface, Mr. Dionis, after reference to "the surprising effects of operations which set such a value on Chirurgery," and after urging the importance of a complete professional education, explains that "Paris furnishes the learner better with means than any city of Europe; there are held publick demonstrations in three different places of the city: at the King's Garden, the Medicinal School, and at St. Cosme, which all being performed by sworn master-chirurgeons of that city, are laid down with utmost exactness." For eight years Dionis gave his "Demonstrations" in the Royal

Garden, the concourse of students being so great that the largest hall would not hold half in attendance, so that tickets were distributed to chirurgeons' apprentices, that they alone might enter to the exclusion of those who were placed to serve their time in barbers' shops and the like.

The demonstrations of the course are ten in number, suitably subdivided, and treat of numerous operations. The seventh demonstration is of interest to us, and proves that the importance of dental surgery was fully acknowledged by this man of note so long ago.

This particular demonstration consists of four sections:—

1. "Of the Polypus of the nose."
2. "For Bleeding of the Head."
3. "For the Hare Lip."
4. "For the Gums and Teeth."

Prefixed to each subdivision is a woodcut exhibiting the various instruments and appliances to be used in the several operations to which reference is made in the text.

Time will not admit of lengthened quotations this evening, so that I can only place before you some reference to section No. 4, although all will be found worthy of consideration at leisure.

"Of operations practised on the teeth," our author observes, "the teeth alone at present [presumably about the year 1700] furnish the whole employment of several persons called operators for the teeth; it must be owned that these gentlemen, the sole object of whose labour are these parts only, may excel in their art rather than the chirurgeon whose science is of an infinite extent. But yet he is not to neglect this part of chirurgery, in which he is to be acquainted that seven sorts of operations are practised.

"The first is the opening or widening of the teeth when they are close together.

"The second, to cleanse them when they are foul.

"The third, to hinder their rotting.

"The fourth, to stop the holes which grow in them.

"The fifth is to file them when they are too long and jagged.

"The sixth, to pull them out when rotten.

"And the seventh, to substitute artificial ones in the place of the natural."

Under these seven heads most careful directions are prescribed, several closely printed pages being devoted to particulars. From these, too, it would seem that really good practitioners of dental surgery existed at the time. For instance, we find the name of Monsieur Carmeline recorded as being "a very able operator for the teeth," who had practised re-implantation.

In stopping, it is explained that gold, silver, and lead were in use. The manner of adopting artificial teeth so as to obviate the inconvenience experienced from their loss in articulation, and to improve appearance, is dealt with; but I do not find these substitutes spoken of as useful in mastication, or indeed as particularly successful at all.

The different forms of dental forceps of the present are properly regarded as effective and beautiful in their adaptations, but after all they are no more than the perfected development of those described by M. Dionis. He says: "A tooth forceps, called in Latin *Denticeps*, is a sort of pincers whose end, which grasps the tooth, is crooked and cleft like a fork in order to take the faster hold. It may be used as well in the upper as the lower teeth, and is one of the most ancient instruments in chirurgy, and has been used in all ages."

I must ask you to pardon me for thus digressing and introducing to notice the work of a thorough-going and conscientious surgeon, who had given all this thoughtful attention to the treatment of dental disease, more than a quarter of a century prior to the birth of our own John Hunter, of immortal memory.

You are aware that, according to a custom which has

existed for some years, a past President would now be called upon to fill the chair, and that Mr. Ibbetson stands next in rotation. I need not tell you how much pleasure it would have afforded the Council to have recommended Mr. Ibbetson for the second time for the distinguished post, but it grieves me to say that, owing to the severe domestic calamity which has so recently befallen him, he feels quite unequal to undertake the duties and anxieties of the Presidency. I am sure that every member will join me in expressing our deep regret that the Society is deprived the advantage of seeing Mr. Ibbetson in the chair, and in offering him our sympathy and condolence upon the severe loss he has sustained.

In the election of Dr. Joseph Walker as my successor, under these circumstances, the members are to be congratulated. Dr. Walker, for a long series of years, has evinced the utmost interest in all that relates to the progress of dental surgery, and particularly to the welfare of the Odontological Society. I am quite sure, therefore, that the dignity of the Society will, under his presidency, be fully maintained.

Gentlemen, in bidding you "farewell" it only remains for me to thank you, in all sincerity, for your generous support during the period I have had the honour of presiding here, and I am especially indebted to the Executive Council, and to the honorary officers, for their confidence and ever ready and invaluable assistance.

Mr. West said he had been requested to propose a vote of thanks to the President for the care and attention he had given to the affairs of the Society during his year of office. He had the greatest possible pleasure in doing so. He believed the Society had never had a more able President than Mr. Rymer had proved himself to be. He only regretted that one who had exercised so much influence on the progress of dental reform, and on the formation of that Society, could not have occupied the post earlier.

Mr. W. R. Wood, of Brighton, said he had great pleasure in seconding the vote of thanks. He was one of those who could remember how, five and twenty years ago, Mr. Rymer had laid the foundation of the condition of things which the profession now enjoyed. He had thoroughly deserved the honour which had been bestowed upon him, and, having conducted the proceedings of the Society most ably, he now fully deserved the Society's thanks.

The President said he could only once more return his sincere thanks to the Society for the honour it had done him. He should always remember the kindness he had received during his term of office. He could not help feeling that he was a provincial President only by accident, as it were, and he hoped before long to see a real provincial member occupying that chair—such a one, for instance, as the gentleman who had so ably presided over the meeting of the British Dental Association at Liverpool.

He would ask the members to give their thanks to the other officers of the Society—the Secretaries, Treasurer, Librarian, Curator, Editor of the "Transactions," and the Council. The President had the fullest opportunities of knowing the value of the services these gentlemen rendered to the Society, and he could assure the members that they most thoroughly deserved acknowledgment.

The vote having been passed by acclamation, Mr. Parkinson briefly replied.

The President then thanked Messrs. Hutchinson and Coleman, and other contributors of Casual Communications, and announced that at the next meeting, on February 5th, a discussion on "The Theory of Caries" would be opened by Mr. Henry Sewill.

The meeting was then adjourned.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

February 5th, 1883.

DR. JOSEPH WALKER, PRESIDENT, IN THE CHAIR.

The Minutes of the previous meeting having been read and confirmed,

The PRESIDENT announced that Mr. Rees Price, L.D.S.Eng., of Montague Place, Glasgow, had been duly nominated as a candidate for election, and would be balloted for at a subsequent meeting.

The following candidates were then balloted for and elected members of the Society, viz. :—

MESSRS. CHARLES MOULDON BAYFIELD, L.D.S.I., of Talbot Road, Westbourne Park.

JOHN BAYLY, 353, Clapham Road, S.E.

THOMAS BIRD, 38, Brook Street, Grosvenor Square.

W. A. CARPENTER HARRIS, M.R.C.S. and L.D.S.Eng., 26, Finsbury Square, E.C.

FRED. HARRIS NEWTON, L.D.S.Eng., 50, Brook Street, Grosvenor Square.

ALFRED SMITH, L.D.S.Eng., Devonshire Road, Holloway.

All as resident members. Also the following as non-resident members :—

Messrs. Edward R. Hockley, 198, Parrock Street, Gravesend.

George J. Lucas, L.D.S.Ed., Northfleet, Kent.

Henry Clay Quinby, 21, Rodney Street, Liverpool.

Melville G. C. Quinby, 21, Rodney Street, Liverpool.

Alfred Rogers, 2, King's Parade, Cambridge.

Walter Smithard, L.D.S.I., 15, Stratford Road, Manchester.

Sidney Greatrix Yates, Berkeley House, Ross, Hereford.

Mr. Redman showed the following specimens:—

(1) Two specimens of calcification of the pulp. In one case the diagnosis was difficult, and was only arrived at by a process of exclusion. The tooth appeared to be quite sound; there was no decay anywhere; but the patient had suffered for a long time from a constant feeling of discomfort in this tooth, varied by occasional very severe paroxysms of pain.

(2) An upper molar with four fangs; the roots were not entirely disconnected, but there were four distinct canals.

(3) A model showing a supernumerary upper temporary lateral incisor. He believed such teeth to be very uncommon in the temporary set, but he had also under his care a boy who had a supernumerary *lower* temporary lateral; he would endeavour to exhibit him at the next meeting.

In reply to a question, Mr. Redman said that the use of a strong light had afforded him no assistance in diagnosing the case of calcification of the pulp, possibly because the calcification was not sufficiently complete.

Mr. Coleman said that he had in the course of his practice seen nine or ten cases of supernumerary *upper* temporary laterals, but had not yet met with a similar state of things in the lower jaw. He had also met with a case in which there were two supernumerary temporary canines, which he believed to be of very rare occurrence. He would exhibit a model of this case at the next meeting.

He also showed an odontome, attached to the crown of a lower molar, which had been extracted by Mr. A. B. Read, at the National Dental Hospital. It appeared to belong to the third division of Broca's classification.

Mr. Nathaniel Stevenson then exhibited an electric lamp, designed for use in dental practice, which he described as follows:—

"For the past twelve months or so I have been using a small incandescent carbon lamp, which has been made for me by the Swan Electric Light Company, and I have found it of so much use that I have been anxious to introduce it to the profession generally, and I thank you for giving me this opportunity of doing so. The cases in which I find it of most service are those in which shadows thrown by all external lights interfere so; with this lamp the light is exactly where we want it and nowhere else; the shadows, if any, are all out of the way. In scaling teeth, where the teeth are long and slope inwards, it is most useful, for the patient holds it in his hand and turns the light in or out whenever it is needed. In extractions under anæsthetics, when there are a number of teeth to remove, the assistant can move it about from one to the other, and greatly help you, especially in dull weather; but there are really so many cases in which it is useful that I have now learned to consider it an absolute necessity.

"The great difficulty in connection with its practical working was to get a convenient battery. I tried many experiments to arrive at the simplest form, and I think the arrangement I have made for it is as suitable as any other. It is a bichromate battery of four cells; the zincs and carbons are counterpoised by lead weights, so that they are most easily raised and lowered when required.

"The cells can be easily removed to be cleaned out and replenished, and, as the four zinc slabs are all fixed to one frame, they are removed bodily from the battery by simply undoing two thumbscrews: this greatly facilitates the difficulty of amalgamating them. In this way it is very

easy to work, and ought not to be expensive to make. The fluid is a saturated solution of bichromate of potash with $\frac{1}{12}$ of sulphuric acid. When once started it ought not to need refilling for about a fortnight, but the zincs should be re-amalgamated every week at least, otherwise they rapidly dissolve. Great care should be taken to lift the metals out of the cells when not using the battery, otherwise it will very soon exhaust itself and waste.

"The little reostat connected with the battery is, as you will see, a most important adjunct, because these batteries all vary in power, diminishing gradually in force as they are used, and unless you have some reserve (which you must be able to control) you may possibly find it fail when most wanted. The carbons of these tiny lamps also vary in their power of resistance, and if you cannot keep back the electric force you may fuse the carbon and utterly ruin the lamp. The construction is a little difficult to explain, but the principle is the same as that employed in all similar instruments, viz., the introduction of a medium of high resistance into the direct current. I have used in this case very fine insulated German silver wire. Hitherto there has been so great a difficulty in making a practical reostat to regulate these small currents, that the superintendent of the Edison exhibition at the Crystal Palace last year declared it to be an impossibility. This is the first time that the apparatus has been publicly shown, and, as I fear that some enterprising individual might be tempted to patent it, I am glad of this opportunity of preventing that, because of course after a thing is published it cannot be patented by anybody.

"I have prepared a rough diagram which will, I think, help you more easily to understand the interior construction; the exterior is simple enough. One end of the divided copper wire is soldered to the socket in which the spindle works, so that the spindle carries the electric current to each of the points with which it is in contact, and through the varying lengths of the German silver wire, to the last one, through which it restores the uninterrupted circuit. The reostat represented in the diagram carries fifteen different points of

contact in 60 inches of resistance, divided up in such a way that, between the last two points there are 9 inches, a rather shorter distance between the next, and so on diminishing in distances between each until the last has only 2 inches between it and the copper wire. The object of this arrangement will be seen when we use it."

Mr. C. J. B. Wallis also exhibited an electric lamp for illuminating the cavity of the mouth, which, though very similar in appearance to that shown by Mr. Stevenson, differed from it in the fact that the light was produced by the incandescence of a carbon filament, on Edison's principle, instead of by the heating of platinum wire, as in Mr. Stevenson's lamp. In the latter, if too strong a current was used, the wire was liable to fuse and the lamp was rendered useless; hence the necessity of the ingenious, but somewhat complicated, reostat described by Mr. Stevenson. The carbon filament being practically indestructible, but little attention need be paid to the strength of the battery. He had been in the habit of using a modified form of bichromatic battery, known as the D'Or battery, which had the advantage of giving a steady current and of requiring less frequent renewal than that used by Mr. Stevenson. Its composition was as follows. Into an ordinary glass cell a porous pot was placed; into this was put a zinc coil and 2 oz. of chloride of zinc; it was then filled up with water. The outer glass cell was filled with broken pieces of carbon, a rod of carbon being inserted down one side. It was then filled up with a solution composed of bichromate of potash dissolved in boiling water to saturation, with half the bulk of commercial hydrochloric acid added when cool. One wire was connected with the zinc coil and the other with the carbon rod. A battery like this would require re-charging every twenty to thirty days, according to the time it was kept in use; but the larger the cells the less often would they require re-charging. Three cells were quite sufficient for the purpose of the light.

Mr. Wallis also showed a Double Induction Electric Motor, made by Grinson of Philadelphia, which, with six cells of the

battery just described, would run a dental engine or lathe at any speed.

He exhibited also an automatic rivetting hammer, designed by himself, in which, by pressing a lever, the hammer, which worked in a frame, could be made to descend with the utmost precision on a given spot.

The PRESIDENT then proceeded to deliver his Inaugural Address as follows:—

PRESIDENT'S ADDRESS.

Gentlemen,

Before I enter upon the main subject of my address I should wish to explain, as briefly as possible, how I come to occupy this chair to-night. Most of those present are aware that in 1873 Mr. Coleman suggested the advisability of re-electing some of our former Presidents once more to rule over the Society: the proposition met with general approval, and in 1875, Mr. Vasey having declined to accept the office that year, Mr. John Tomes was unanimously elected to serve a second time as President. Since then the chair has been occupied every alternate year by one of the earlier Presidents of our Society, and to-night Mr. Ibbetson should be engaging your attention with an address from his master mind, had not affliction of the deepest nature prevented him from occupying so honourable a position.

Mr. Parkinson, our worthy Treasurer, would, in the ordinary course, follow Mr. Ibbetson, but he has also declined to serve his second term of office this year, consistently acting up to his principles that circulation, free circulation, is the life vigour of institutions such as ours, and that new blood should be introduced as liberally as possible into all the offices of the Society.

Your Council therefore nominated me, and you have ratified my election by your unanimous vote. I need hardly tell you how highly I esteem this evidence of your consideration. Still I hesitated long before I accepted the position I hold to-night. I cannot lay claim to any of the attributes which my friend Mr. Coleman considers a man should possess in order to be entitled to a seat in this chair as your President

Mr. Coleman, when he first proposed the re-election of former Presidents, gave utterance to the following sentiments:—

"The President of a learned Society like ours should, I conceive, be one who has been largely instrumental in extending the bounds of the science which the Society he presides over was founded to develop; his name should be known beyond the narrow circle of his own profession; mere interest in the Society, with success in practice, should be no passport to that seat of honour. The true success of a Society such as ours is evinced more by the status of the Executive, and especially of that of him who presides over it, rather than by the numbers of its members."

Gentlemen, I cannot point to any original investigations, undertaken or carried through. The only work I can recall with pleasure is that I have been for many years a teacher in two medical schools, and have endeavoured, to the best of my ability, to make use of our accumulated store of knowledge, and, by example and diligence in teaching, to stimulate others to work for the love of work, hoping that such seeds may propagate in bigger brains than mine. All that I can offer you to-night is that I will, to the utmost of my ability, uphold the dignity of this Society, and advance its interests in every way open to me.

Having said this much by way of preface, I have now to turn to the more serious business of my address. And here, as I looked over the varied utterances of my predecessors, my difficulties appeared at first almost insurmountable. Successive Presidents have, in their turn, dwelt on the formation and early history of our Society—on its objects, usefulness, progress, financial position, and successes. What is there left unsaid that I can hope will interest you? My difficulty is increased by the fact that I follow such an acknowledged leader in dental politics and dental literature as our late President, Mr. Samuel Lee Rymer. To him we are much indebted,—how much is only known to a few. He has been

all through life an original thinker, a strong reformer, a most enthusiastic worker. In every movement for the advancement of dental education, or for the progress of the profession, he has been foremost, helping not only with advice and monetary assistance, but giving valuable time and personal attention to details. In following him I have indeed no easy task.

As in many of these Presidential Addresses a retrospective line has been adopted, I shall to-night dwell more particularly upon the work that lies before us, and consider how in my opinion we can best advance the interests of the profession and of the Society in the future.

Yet may our interest in the present and our schemes for the future never cause us to forget the debt of gratitude which we owe to the founders of this Society. We should ever venerate the names of Parkinson, Cartwright, Tomes, Harrison, Rogers, Ibbetson, Biggs, and the rest. I was a junior member of the profession in those days, yet I well remember the solicitude of those men for the success of our earliest meetings. It was a noble work for such men to make common property of knowledge which they had taken years to acquire, and to impart willingly all they knew for the benefit of those who had hitherto been too often looked upon rather in the light of unfriendly rivals. Minds capable of such abnegation must always deserve our warmest appreciation. The free participation of sound knowledge was the groundwork and basis of this Society, and the same willingness to impart must be maintained by its members of the present day, if it is to continue a healthy, vigorous, scientific existence.

I must not omit also to congratulate you on the fact that the Odontological has at last taken up its proper position in the ranks of the Medical Societies. It was with the deepest interest that I proposed in the council chamber the rule that in future all new members must possess a qualification satisfactory to the Council. To me this is a natural outcome of the

Dentists' Act. The rule must, moreover, produce in time a beneficial effect by raising the scientific character of the Society. Our new members, trained to the investigation of scientific facts, will bring a clearer intelligence to bear upon the communications set before them, and will be able more readily to deduce from them all that promises to be profitable and interesting, and to reject that which is false or valueless. It rests with us to make our meetings sufficiently interesting and instructive as to induce all the young men now passing into the profession to become members, and to continue their education within the sphere of the Society.

I will, in the next place, take advantage of this opportunity in order to say a few words with reference to a department of the work of the Society with which I have for several years past been actively concerned,—I mean the editing and publication of the "Transactions." My predecessor, in the course of the address delivered at our last meeting, referred to the apparent delay in issuing these records of our proceedings, and suggested that arrangements might be made by which each number might be posted to members within ten days after the meeting. No member would be more pleased than myself if this could be achieved. It is, in fact, a matter which has constantly engaged my attention. The delay is due partly to the fact that, in order to secure accuracy, a transcript of the reporter's notes is sent to each of the principal speakers in the discussions; and although these gentlemen are particularly enjoined to return the MS. without delay, it seldom happens that the request is strictly complied with by all of them. And another cause of delay is that the papers are not unfrequently brought here to be read whilst still in an unfinished state, and are then either taken home by the author for the purpose of completion or correction, or else the proof which is sent to him is detained for a considerable time in order to carry out the necessary process of revision.

In order to obviate the first-mentioned source of delay I

have to-night suggested to the Council the adoption of the plan followed at the International Medical Congress, viz., that each speaker should write out his remarks immediately on resuming his seat, and should hand these memoranda to the Secretary before leaving the meeting. Whilst as to the second cause, we have a means ready to hand, if only duly enforced, which would not only greatly accelerate the issue of the "Transactions," but would also go far to secure that all papers read before the Society shall be in all respects worthy of its consideration. I would remind you of the fact that a Publishing Committee is appointed each February by the Council, and also of the existence of the following Rule:—

Rule 45.—"They shall, at their first meeting after the Annual General Meeting, in January, appoint the Library Committee, a Committee to examine the specimens presented for exhibition, and a Committee to report on the merits of communications made to the Society with a view to publication."

Amongst the questions which must before long engage the attention of our Council, one of the most important is that relating to the present condition of the Society's finances. Thanks to the careful management of our present worthy Treasurer and his predecessors, the Society now possesses invested capital amounting to over £2,000; whilst for some years past, notwithstanding a tolerably liberal expenditure on our Museum and Library, there has been an average annual excess of receipts over expenditure of about £100. There appears to be a pretty general opinion amongst our members that, for a Society constituted as ours is, the balance we now possess is amply sufficient, that the interest of this accumulated fund might now be safely applied to the advancement of scientific and technical knowledge, and that steps might now be taken to make our expenditure more

nearly balance our receipts without in any way impairing the stability of our financial resources.

I am aware that this question has for some time past been a frequent subject of private conversation amongst members of the Society, and no doubt others besides myself have arrived at conclusions, more or less satisfactory to themselves, as to what it would be best to do under the circumstances. In making, therefore, the following suggestions, I need scarcely say that I put them forward merely as suggestions, knowing that the whole matter will be most carefully and exhaustively discussed by the Council, with the able assistance of the Treasurer, and that any propositions bearing upon the question will be gladly received and duly attended to.

It has been suggested that we should reduce our subscription from two guineas to one guinea annually. I cannot myself see that such a change is in any way necessary or advisable. On the other hand, I think that there are several ways in which we might, with great benefit to ourselves individually, and with advantage to the Society's reputation, make our expenditure more nearly equal our receipts.

In the first place, after giving the matter my careful consideration, I would suggest that we might, with great advantage to ourselves, introduce a new element into the constitution of the Society by appointing, either annually or biennially, a Travelling Fellow. The appointment should carry with it a sum sufficient to enable the holder of it to visit the more advanced continental schools of dental surgery or of practical chemistry, or to extend his travels to the great American continent, gathering from all departments of science such information as may conduce to the advancement of our professional knowledge or the improvement of our techical appliances. The gentleman chosen for this office should, at the time of accepting the appointment, undertake to make a written report to the Society of the results of his observations and experiences,

to be read at one of our monthly meetings specially set apart for that purpose. He should also undertake to give a clinical demonstration at our June meeting. The Travelling Fellow should be elected by ballot at our Annual Meeting, the names of those to be balloted for having been selected by the Council from amongst the most highly distinguished and best qualified members of the Society.

A plan similar to that which I have suggested is already in operation at Oxford, known as the "Radcliff Travelling Fellowship," three fellowships of £200, tenable for three years; full particulars are given in the "Oxford University Calendar," page 49. At Cambridge "a Travelling Bachelor," founded by Wort; £100 a year for two young Bachelors of Art; particulars in "Cambridge University Calendar," page 298. In the army and navy, and in some of our literary societies, and most valuable results have frequently been obtained by its means. The prospect of gaining such an appointment would be a powerful stimulus to the students of our various dental schools. It would, I feel sure, be esteemed as one of the highest prizes in the gift of our body; and that this scheme, if well carried out, would also be one of the best means of maintaining the prosperity of the Odontological Society.

I have mentioned, as one of the conditions to be attached to the Travelling Fellowship, that the holder of it should agree to give a clinical demonstration at our June meeting, and this leads up to another suggestion which I would put forward for the consideration of the Council. I would suggest a change in the character of that meeting. I would ask the Council to consider whether it would be practicable, and also advisable, with the kind co-operation of the managing committee and medical officers of our Dental School, to hold once each year a "clinic." Should the Council consider it wise to hold such a meeting, I have received the promises of several eminent members of the profession, who would be willing to take chairs and to demonstrate their manipulative skill in some carefully

selected dental operation. With your approval I would also offer from this chair a prize of twenty-five guineas to the most skilful and scientific operator in gold filling. Mr. Chas. Tomes, Mr. Claude Rogers, and Mr. Robert Hepburn have kindly consented to act as umpires in this matter. This competition would take place at such a time and under such conditions as may be found most convenient to those concerned, our object being that the competitors shall be taken from as wide a field as possible, it being, however, understood that the successful competitor shall be willing to take part at our June clinic.

I believe that this clinical evening would be found greatly to interest the general body of dental practitioners. It would also, I trust, lead them to realise more clearly the fact that however proficient as an operator the student may be when he leaves the hospital, the advances made by dental surgery are so rapid in our day that unless he is unusually quick in availing himself of every chance of improvement, he will at the end of a very few years find himself altogether behind the times. I am sure that it would well repay a large number of practising dental surgeons, both London and provincial, if they could get the managing committees of the various dental schools to grant them the privileges of a life subscription, so that whenever they are in a town with a dental school, they may have the right of entry to see and learn whatever may be new to them, and thus be enabled to keep abreast of the times in general professional knowledge, and especially in good practical work.

At all our large general hospitals one day in the week is set apart as an "operation day;" a list of the operations to be performed, with the surgeons' names attached, is advertised beforehand, and it is the practice to admit any qualified surgeon on presentation of his card, to see the operations from the theatre gallery. This enables men engaged in practice to see the most skilled operators treat either slight or difficult cases. The Cottage Hospitals, also, in rural dis-

trict have proved of the greatest possible benefit, not only to the poor, but to the surgeons themselves, who operate in each other's presence, assisted frequently by fellow-practitioners belonging to the same district; and thus a most desirable spirit of emulation is produced, which has raised the capabilities of the general surgeon to a point unknown in former times.

It would be a great inducement to members of our profession to continue their education from time to time as opportunities offered themselves, if the authorities of our dental schools would follow the custom of the general medical schools, and would subdivide the fees for hospital attendance and for the various courses of lectures. An extract from the prospectus of St. Thomas's Hospital Medical College will illustrate my meaning fully. It informs us that "the winter session commences on October 1st, the summer session on May 1st. Students can enter at the commencement of either session." The fees may be paid in one sum, or by instalments, or special entries may be made for separate courses of lectures or departments of hospital practice. Special arrangements are made for students entering in their second or subsequent years, also for dental students. Qualified practitioners can obtain perpetual tickets on payment of a small fee, &c. And it is not only the general hospitals that do this: it will be found on inquiry that the various special hospitals are almost equally accommodating. Even some amongst dental schools carry out this idea to some extent,—*e.g.*, at National Dental Hospital, and also, I believe, at Glasgow, practitioners are admitted to special courses of lectures and to hospital practice.

A policy of this kind on the part of our dental schools would certainly increase the interest taken in them by the profession at large; whilst the occasional presence of a practitioner as a member of the class would stimulate both medical officers and students to show themselves at their best, and would put everybody on his mettle.

I have purposely refrained from entering upon any financial or other details connected with the schemes I have submitted to your notice, but should the funds of the Society permit, there are yet other ways in which they could be most profitably disposed of. For instance, an annual prize might be offered for the best essay on such subjects as "The Causes of Dental Caries," "The Best Means of subduing Subacute Inflammation of the Mucous Membrane," "The Causes of Erosion of the Enamel," &c., &c.

But I have occupied quite enough of your time, and am much obliged to you for the kind attention with which you have listened to my remarks and suggestions. I hope that as the session advances some promises from old friends will be redeemed, and that we may have the pleasure of listening to papers by Mr. Macnamara, Charters White, Coleman, Henry Power, Dr. Thorowgood, and Mr. Sewill.

Mr. Edwin Saunders, in proposing thanks to Mr. Woodhouse for the zeal and ability he had shown in the chair, expressed what, according to his own idea, an ideal President should be:— "He should be patient and forbearing in the execution of his duties, tolerant of others' opinions, and not too persistent in his own; he should be sparing of speech, and when he did take part in the discussion his words should be genial and suggestive, calculated to elicit the opinion of others; he should also be thoroughly impartial, giving both sides an equal hearing, and not given to force his own opinions on the meeting."

Gentlemen, I hope to follow the lines of Mr. Saunders' ideal President, and I trust that each member will, on his part, give his cordial assistance to the Chair, and thus help to make my year of office as President a pleasurable one.

Discussion on the Theory of Caries.

The President then called upon Mr. Henry Sewill to open the discussion on "the Theory of Caries," of which notice had been given on the Agenda paper.

Mr. Sewill said that, as in any debate of this kind it was most important that the exact nature of the subject to be discussed should be clearly understood, he would commence by reading the question which had been decided upon by the Council to serve as a basis for the discussion. It was as follows:—"*Do the incontrovertible facts which we now possess as to its etiology and pathology fully account for the phenomena of dental caries?*"

In his opinion there was no doubt that this question should be answered affirmatively. He believed that we now possessed a store of facts amply sufficient to account for all the essential phenomena of the disease. It was true that caries had been for many years successfully treated without any theory at all. It might therefore be asked by some what practicable good was to be expected of such a discussion as the present. But though the treatment which had been empirically followed had certainly been fairly successful, still there was no knowing but that it might be modified with advantage could we be certain of the true nature of the disease. Whilst as to the *prevention* of caries, towards which little had been done as yet, this must depend almost entirely on our knowledge of its etiology and pathology.

Considering the importance of the subject—for caries was by far the most important of all dental diseases—it was remarkable that the question had remained so long unsettled. Even quite recently papers on this subject had been read before the Society based on somewhat astonishing physiological and pathological hypotheses. It had also been publicly stated by a member that no explanation could be

given of the origin of caries; some even still asserted that it was a constitutional disease, &c.

The first point to be decided was whether caries was due to external or internal causes. After that it might be possible to consider what were its exciting causes, and what its predisposing causes; what was the exact nature of the morbid changes in the tissue, and whether the tissues showed any vital reaction during the progress of the disease, or were merely passive.

He had no hesitation in saying that caries must be looked upon as a disintegration of tissue due to the action of *external causes*. The anatomical characters of enamel and dentine appeared to negative the possibility of their being the starting point of pathological action; or if such a thing was possible in dentine, it could not be possible in enamel,—a densely hard, almost homogeneous mass, containing a mere trace of organic matter. And it was in enamel that caries commenced, unless it started in a fissure. If caries commenced in these tissues as a true disease, we should certainly expect to find at an early stage some vascular disturbance of the pulp; but this never occurred. It was true that inflammation might occur in the cornea and other non-vascular tissues, but no gross lesion comparable to dental caries could take place even in the cornea, without vascular change. Nor were the cornea and dentine parallel cases; the one was soft and permeable, the other dense and hard. Dentine was, indeed, as a tissue unique.

It appeared to him there was one fact alone without those mentioned which effectually settled this question, viz., the fact that caries occurred in dead teeth and in artificial teeth made of ivory. It had been said that the vitality of the tooth would resist the action of external agencies. But though vitality might modify the process to some extent, causing pathological changes, it could not protect the tissues from the action of physical laws. A drop of nitric acid would destroy the skin, whether living or dead; and similarly acid would act upon a tooth whether living or dead.

What then were these external causes? One was *acid*.

This was derived from the decomposition of food, from deranged secretions, acid mucus, &c. The minute phenomena of caries had lately been more fully cleared up by the investigations of Messrs. Underwood and Milles. They had found minute organisms flourishing in the organic matter of the dentine, and this accounted for the more rapid destruction of dentine than enamel. These organisms were of course introduced from without, and the chief point was that the whole process was due to the action of external causes.

Various objections to this view had been put forward, but these had all been satisfactorily explained. Thus it had been shown that the "translucent zone," which had at one time been thought to be a sign of "vital action," was equally well seen in dentine when softened by acid out of the mouth. So also with regard to the varicose condition of the dentinal fibres seen in carious teeth; these had also been shown to occur in dead teeth out of the mouth.

In the next place, what were the predisposing causes of caries? These might be shortly stated as anything which would be likely to render the enamel and dentine more easily acted on by acid; thus, fissures and other malformations of the enamel; soft porous enamel, and soft, badly formed dentine, containing interglobular spaces; crowding and irregularity of the teeth, favouring lodgment of decomposing *débris*, and interfering with proper cleanliness; and lastly, anything which tended to cause the formation of acid within the mouth, such as a bad state of the secretions, chronic dyspepsia, &c.

It had been asserted that the fact that the appearance of caries would sometimes date from an illness was a proof that the disease must be due to a constitutional state. But, in the first place, the change was not attended by any vascular phenomena, such as were met with in other lesions of constitutional origin, in whatever organ they might occur. And secondly, the condition of the mouth during many derangements of health, and many diseases, was eminently favourable to the existence of the local causes he had men-

tioned. In a case of typhoid fever, for instance, the teeth would be found covered with collections of vitiated mucus and partially decomposed food, which might remain for weeks; in pregnancy, as another instance in point, there was frequently a soft spongy state of the gums, with secretion of acid mucus, and often gastric derangement besides; in chronic dyspepsia the condition of things was somewhat similar,—unhealthy secretions, acid eructations, &c.

He did not pretend to speak as an authority who had made original investigations on this subject. He was only expressing his own individual opinions. But it did appear to him that the evidence in favour of the local origin of caries, and that it consisted of disintegration of the tissues without pathological phenomena of any kind, was almost overwhelming. He thought it was impossible for any one who read carefully through the masterly summary which was given in Messrs. Tomes's work, based on original research, to continue in doubt on this question. The conclusion arrived at by these authors was that caries had, properly speaking, no pathology.

The well-known work of Wedl also gave a most philosophical and judicial review, based on original investigation, of all that was known on this subject. He described dental caries under the head of "Anomalies of the Secretions," and decided strongly against the existence of any inflammatory origin, or of any vital reaction in the tissues during the progress of the disease.

Leber and Rottenstein also furnished important corroborative evidence, though they were mistaken in ascribing to the action of leptothryx what was no doubt due to the action of bacteria and other organisms. Magitôt also had, by a careful series of experiments, shown that enamel and dentine were destructible in acids not stronger that those formed in the mouth. So also Westcott, Allport, Mantegazza, and last, but not least, Messrs. Underwood and Milles, had all produced important evidence to show that caries was due to ordinary physical causes acting from without.

In his desire to be brief, he had left out all reference to

several most important points bearing on this question; but he knew there were other members ready to take part in the discussion, and that some of them were more competent to deal with these matters than himself. He hoped that the Society would be willing to discuss the question thoroughly, since this might possibly have the very desirable result of removing, to a considerable extent, the state of uncertainty in which it had so long remained.

Mr. A. Coleman said Mr. Sewill had started with the proposition that, inasmuch as dental caries commenced on the surface, and was due entirely to external causes, it was not a disease. But if they accepted that definition, they would have to exclude from the category of diseases many morbid conditions which had hitherto been included within it. Thus, some of the skin diseases, ringworm and favus for instance, commenced on the surface, and were due entirely to external causes. It was true that in the progress of these diseases inflammatory conditions were manifested, and that such conditions had not been clearly demonstrated in dentine during the progress of dental caries. It was hardly to be expected that such manifestations could be made apparent in a structure of such a character, but the fact must not be ignored that some investigators maintained that such changes could be shown. Putting aside the disputed nature of the "translucent zone,"—claimed, however, by Magitôt, a strong advocate of the chemical theory of caries, as an evidence of vital action in the dentine,—there were the researches of Dr. Frank Abbott, who demonstrated that, in the enlarged canaliculi, granules and threads exist which took up carmine, whilst in parts further affected these were filled with partly-nucleated protoplasm. These phenomena might of course be explained as indicating the presence of organisms, originating from without, and which had found their way into the canaliculi. But if this were so, what could be said in the case of caries occurring in cementum? He thought it could hardly be denied that we had found the same evidences of inflammatory action, shown by the

presence of corpuscles, as appeared in bone during the progress of inflammation.

Mr. Sewill stated, with considerable confidence, that precisely the same conditions occur in the decay of dead teeth as in that of living teeth. Now this was a point upon which all were not agreed. Dr. Frank Abbott stated distinctly that the appearances presented under the microscope were not the same in the two cases; and he (Mr. Coleman) would also say that, in his opinion, there were differences in the general appearance and conditions met with in each. In the case of teeth attached to artificial dentures, the softening of the dentine was more general and superficial, and the enamel was more friable than in the case of living teeth affected by caries. It was also his opinion, founded on long observation, that dead teeth and teeth that had their pulps devitalised, when attacked by decay, ran a more rapid course, and that the softening was less circumscribed than in teeth with living pulps.

That the appearances presented by decay in dead teeth and the condition termed caries in living teeth, should, in the parts actually affected, present very similar appearances, was what the advocates of a vital theory would strongly maintain. Those who believed that a healthy living tooth possessed an inherent power, which protected it from external chemical influences, would admit that a tooth attacked by caries had lost that power, or that it had been overcome in that part which had become affected by the disease.

With regard to the external influences which might, directly or indirectly, determine caries, an acid state of the secretions of the mouth was no doubt an important factor. But if it were the sole cause, would not the result be a more general action upon the teeth? as had, indeed, been pointed out by Hunter. And then, with regard to the evidence of this acid state of the saliva, he had himself, many years ago, made a very large number of observations upon this point, expecting to be able to connect an acid condition of the saliva with, at all events, very active or acute cases of caries. But he obtained no such result. In cases of preg-

nancy and those convalescent from the exanthemata, the conclusion was the same, and yet in such cases it often occurred that teeth which, until these conditions supervened, had been excellent, then underwent very rapid decay. This had led him to doubt very much a simply acid cause for caries, and had brought him to believe that the greater liability to disease in such cases arose from a lowering in the power of resistance of the teeth to agencies external to them,—that is to say, to the ordinary laws of chemical affinity.

The usual hour for adjournment having arrived, the President suggested that, as no doubt there were many other members anxious to state their views on this question, it would be a pity to attempt to finish the discussion that evening, and he would put it to the meeting that it be adjourned till next month.

This having been agreed to, the President announced that on March 5th a paper would be read by Dr. Thorowgood, the title of which he could not then announce, and the discussion begun that evening would be resumed.

The meeting then terminated.

W. A. N. CATTLIN, F.R.C.S. AND L.D.S. Eng.

From a Photograph by HANNAH & KENT, *Brighton.*

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

March 5th, 1883.

DR. JOSEPH WALKER, PRESIDENT, IN THE CHAIR.

The Minutes of the previous meeting having been read,

MR. COLEMAN called attention to the fact that the case of the two supernumerary temporary canines, said to have been spoken of by him, had really been mentioned by Mr. Ackery.

This error having been corrected, the Minutes were confirmed.

The following gentlemen then signed the Obligation Book, and were formally admitted to membership by the President, viz.:—

MESSRS. W. A. CARPENTER HARRIS, EDWARD R. HOCKLEY, GEORGE J. LUCAS, ALFRED ROGERS, and ALFRED SMITH.

The PRESIDENT announced that the following candidates for membership had been duly nominated, and would be balloted for at a subsequent meeting, viz.:—

MESSRS. ARTHUR ALEXANDER MATTHEWS, L.D.S.Eng., 12, North Parade, Bradford;

REES PRICE, L.D.S.Eng., Montague Place, Glasgow.

The following candidates were then balloted for and elected members of the Society, viz.:—

MESSRS. JOHN FAULKNER, L.D.S.I., 22, Old Burlington Street, W.

William Horn, M.R.C.S. and L.D.S.Eng., 32, Oxford Road, Kilburn; and

W. R. Humby, L.D.S.Eng., 88, Newgate Street, E.C., as resident members.

Thos. C. Stellwagen, M.D., D.D.S., of Chestnut Street, Philadelphia, was elected a corresponding member.

Mr. C. J. Boyd Wallis showed some models illustrating the treatment of epuloid growths by means of electrolysis. In one case, of which three models were shown, the patient, a lady, fifty-three years of age, had an epulis of considerable size on the upper jaw, situated over the site of the last molar tooth. This had been removed three years previously, but the tumour first appeared about three years before its extraction. There was considerable flow of saliva, with some swelling and tenderness at the angle of the jaw and down the side of the neck; her general health was not good. The electrolytic treatment, which was carried out by Dr. McOscar, extended over six months, the current being applied daily for the first month, and afterwards once a week. It caused no pain beyond the pricking of the needles, unless these were by accident allowed to touch the maxillary bone or the periosteum, when it became rather acute—resembling severe toothache. Now the patient's health had greatly improved, there was no pain or tenderness, and all that remained of the tumour was some indurated cicatricial tissue, which did not interfere with the adaptation of artificial teeth.

Model No. 4 was a similar case, but of dense fibrous tissue, situated over the left lower bicuspid and molar.

No. 5 showed a vascular epuloid growth situated over a badly decayed lateral root, which Mr. Wallis successfully treated by electrolysis within a week.

Mr. Wallis also showed models of some interesting cases of abnormal dentition, including eruption of right upper canine, in a lady between forty and fifty years of age, geminated lower lateral and canine, and several cases of supernumerary teeth. One of the latter showed three perfectly formed upper central incisors, another symmetrical supernumerary teeth on outer

edge between upper second and third molars on both sides, and a third a supplemental wisdom tooth. There were in all twenty-nine models, illustrating various forms of irregularity.

Mr. Wallis then called attention to some electrical appliances, the details of which he explained more fully at the close of the meeting. These included a bichromatic battery, with some improvements suggested by himself, which would work from four to six weeks without re-charging, and would run for three months, or even longer, if an ounce or two of fresh solution were added to each cell every week. The battery of eight cells was sufficient for a lamp of 7–10 candle power. He added that he was sorry he had misunderstood Mr. Stevenson when speaking of his lamp at the last meeting. He thought Mr. Stevenson said his lamp consisted of a fine platinum wire enclosed in an exhausted chamber; hence he had said that Mr. Stevenson's lamp was inferior to that exhibited by himself, which would stand a considerably stronger current of electricity without fusing. He now understood that Mr. Stevenson's lamp was similar to his own, differing only in the material from which the carbon was made.

Mr. N. Stevenson again exhibited his method of lighting the mouth by the incandescent electric light. The lamps used are Swan lamps, an inch long and a quarter of an inch in diameter, the carbon filament being about a quarter of an inch in length. One was mounted on a long tube and covered by a glass shade, which was hermetically sealed to the ivory socket on which the lamp rested. The wires passing through the tube were so arranged as to allow the patient holding it to turn the current on and off at will; external air admitted through the tube maintained a moderate temperature. Another lamp was fitted in like manner to a larger vulcanite socket, which serves as a prop to keep the mouth open during operations; in this case the current was regulated by the operator. The electric current was produced by a four-celled bichromatic battery, and was regulated by the rheostat described at the last meeting.

Mr. Ackery said that at the last meeting he had mentioned

the case of a boy, five years of age, in whom two supernumerary caniniform teeth were to be seen in the lower jaw—one on each side, between and behind the lateral and canine. He now exhibited models of the case as seen in May, 1877, and also of the boy's present condition, from which it would be seen that the two temporary supernumerary teeth had now two permanent successors. The boy himself was also present for inspection.

The following were the principal facts of the case. The lad first sought advice on May 10th, 1877, when he (Mr. Ackery) was house surgeon at the Dental Hospital, and the following notes were then taken :—

"Albert L., age five years, presents two supernumerary temporary caniniform teeth in the lower jaw, situated between and posterior to the lateral and canine on either side, and entirely within the normal arch. His mother states that these teeth did not begin to appear until two years after the completion of the usual series. A model was taken, but as the teeth were causing no inconvenience they were allowed to remain."

After the last meeting Mr. Ackery sought out the original notes in the hospital "Special Case Book," found the patient's address, and wrote requesting that he would come up again for examination. He accordingly presented himself at the hospital on February 12th, when the notes of the case were continued as follows :—

"The patient, who will be eleven years of age on the 27th prox., now presents *eight* teeth between the permanent lower canines, arranged in two rows of four each. The two teeth to the left anterior row are members of the temporary series which have not yet been cast off. The remaining six are so nearly alike in size and shape that it is difficult to say which are the two supernumeraries. It is curious to note that, although the temporary supernumeraries were distinctly caniniform, their successors resemble more closely the permanent incisors."

Mr. Ackery added that he had examined the mother and four other children, but had been unable to discover any evidence of a tendency to hereditary dental abnormality. In the collection of supernumerary teeth in the Society's museum,

only one of the 113 models showed a *temporary* lower supernumerary tooth, and there was no case of more than one extra tooth in the temporary series, nor any example of a corresponding excess in *both* dentitions.

On searching the "Transactions" he found only two recorded cases of a temporary supernumerary tooth being followed by an extra tooth in the permanent series, viz., one by Mr. Coleman in June, 1875, and another by Mr. Chas. Rogers in February, 1876.

The patient was then introduced and examined by the members present.

Mr. J. S. Turner said he had some specimens to exhibit which, though of no great importance from a scientific point of view, might be interesting to the members on account of the stir the case made a short time ago. Through the kindness of Dr. Yarrow he had been able to obtain models of the mouth of the girl whose body was left, packed in a box, at a carrier's office in the Goswell Road about two months since, and also the loan for the evening of her lower jaw, which had been removed for the purpose of more careful examination.

When the mouth was first examined, by gentlemen who were probably not often in the habit of making a critical inspection of the teeth, it was thought that the girl was somewhat older than she was afterwards decided to have been, and it was also thought that the posterior right upper bicuspid had been removed in order to relieve overcrowding. There were, in fact, three molars present on the right side of the upper jaw; but the anterior of the three, which was at first thought to be a permanent tooth, was really a temporary molar, which was only retained in place by lateral pressure between the first bicuspid in front and the six-year-old molar behind, the eruption of the second bicuspid having been thus retarded.

In the lower jaw there were also two temporary molars remaining. The canines were fully in position in both upper and lower jaws, and so were the upper anterior bicuspids. The child's mouth was small, and the teeth were also small and neat. Taking everything into consideration, he thought

that the conclusion ultimately arrived at was correct, viz., that the girl must have been about fourteen or fifteen years of age.

Except the retarded eruption of the upper second bicuspid, and the somewhat early eruption of the wisdom tooth, there was nothing in the case specially calculated to arouse professional interest. But as so much had been said and written about it, he was glad to be able to give the members an opportunity of judging for themselves how far the conclusions arrived at were correct. Generally speaking he thought that the evidence afforded by the teeth was not valued as highly as it should be in legal investigations.

Mr. Chas. Tomes thought that taking all things into consideration there could be no doubt that the age of this girl must have been between fourteen and sixteen. At the same time the condition of the teeth was in some respects anomalous. Of course the non-eruption of the bicuspid was merely an accident; but it was somewhat remarkable that the roots of some of the teeth, which one would have expected to find complete, were not so. This was the case with nearly all the incisors, and with the six-year-old molars. On the other hand, the third molar was more advanced than might have been expected. The statistics which we possessed with regard to the condition of the teeth at this age were not quite as satisfactory as could be wished. This was owing to the difficulty of getting a sufficient number of jaws; it was comparatively easy to get the jaws of young children, but more extended observations were required before we could be quite sure as to the normal condition of the teeth between the ages of nine and fourteen years.

Mr. Hutchinson thought that any one looking at the jaw for the first time might be readily pardoned for thinking that its owner had been more than sixteen years of age. The teeth generally looked more worn than one would have expected to find them at that age, and one of the wisdom teeth was nearly erupted.

Mr. Coleman said he thought the development of the

coronoid process and tuberosity indicated about fifteen years of age, in spite of the fact that the wisdom tooth was rather forward.

Mr. Turner replied that if Mr. Hutchinson would examine the teeth carefully, he would find that the six-year-old molars were the only teeth which presented distinct evidences of wear; the others, especially the bicuspids, both upper and lower, being little or not at all worn.

Mr. Hutchinson handed round a model which had been given him by Mr. Cornelius, showing a supernumerary temporary incisor (upper central); the patient's age was three years three months.

The President then said that the next business on the agenda paper was the continuation of the debate on the Theory of Caries, which had been adjourned at the last meeting; but as it was evident that there would not be more than sufficient time that evening for the reading and discussion of Dr. Thorowgood's paper, he thought it would be better to postpone the continuation of the adjourned debate, and he would at once call upon Dr. Thorowgood for his paper.

On Therapeutic Agents for the promotion of Osseous Development.

By John C. Thorowgood, M.D., F.R.C.P.
Lecturer on Materia Medica at Middlesex Hospital, &c.

The study of the process of nutrition and growth has been said to be the crowning point, or final aim, of all research in physiological chemistry.

There is not likely to be growth without nutrition, and it is from lack of proper nourishment that we see certain particular organs of the body fail in function and waste in structure.

The maintenance of the healthy nutrition of the human race is a business concerning every department of medical, surgical, and physiological science. Public health officer, physician, and surgeon are here called upon all to labour in harmonious concord, and my special purpose this evening will be to endeavour to indicate the benefit that may be looked for as a result of a good understanding and co-operation between the physician and the dental surgeon. Illustrations of the important relation of the dental art to that of physic are numerous enough: one example shall be enough. A gentleman, twenty years ago exactly, became such a

martyr to dyspepsia that powders of bismuth and soda were regular concomitants at all his meals, and a physician, now deceased, who in his lifetime stood as one of the highest medical authorities of the day, pronounced the patient to be affected with cancer of the stomach, which malady would soon end his days. A well-known dental surgeon advised the patient to allow him to remove some old roots of teeth and fit him with a good set of artificials. This proposal seemed so startling, and almost mocking when made to a man who had been assured that he was gradually sinking into his grave under an evidently fatal malady, that it required some further consideration and consultation before it could be entertained; it was, however, not only entertained, but acted upon, and I can testify to the fact that the patient regained his digestive power, and is now a fairly vigorous man of eighty-four years.

Here was a case where nutrition was failing most unmistakably and distressingly; and who can fail to admire the acute observation of the man who detected why it failed, and then with his clever art restored strength, vigour, and enjoyment of life to the patient so that he has long outlived both his physician and his dentist. It is not always, however, that the cause of wasting and failing nutrition is as obvious and as remediable as in the case just narrated. In young and growing

subjects we often observe failure or perversion of nutrition to an extent that leads to serious and by no means unfounded apprehension as to the future.

The subject that I would wish specially to bring before this meeting is, Failure of nutrition in the osseous tissues: its causes, and the best remedial measures and therapeutic agents for the promotion of osseous development.

The hard or osseous tissues of the body are represented by the bones and the teeth. The best analysis of bone shows that it contains in 100 parts—

Phosphate of lime	57 parts.
Carbonate of lime	8 „
Fluoride of calcium	1 „
Phosphate of magnesia	1 „
(Lehmann iii, 18.)	67 parts + 33 cartilage.

With regard to the teeth, Lehmann tells us that the mineral constituents of dentine are identical with those of the bones, and occur in nearly the same relative proportion. The quantity of carbonate of lime varies more than it does in bones, however, from 3 to 8 of carbonate of lime having been found with 65 to 67 of phosphate of lime.

The tooth enamel differs from the dentine inasmuch as from it no cartilage can be obtained, whilst the total of organic matter in the enamel does not exceed 2 to 6. The tooth cement is very closely allied in composition to bone. The chemistry of carious teeth does not teach us much, but

according to Marchand the tendency of teeth to this mode of destruction may be referred to their containing excess of carbonate of lime.

I venture just to remind you of these matters of physiological chemistry, elementary though they be, for they prove the necessity of mineral food for the nutrition of osseous tissues.

Proof of the way in which the animal system absorbs and turns to account mineral matters is afforded by the fact that if the leg of a hen be fractured, while this fracture of bone is repairing any eggs that the bird may lay will be soft, and without hard shell: the reason being that the earthy salts required to harden the egg-shell are wanted to harden the new bone at the seat of fracture. We may see these conditions reversed in the human female; for if a pregnant woman meet with a fractured bone, repair is slow, for the reason that the earthy lime salts are all required for the nutrition of the osseous tissues of the fœtus in utero. The tendency of the system during pregnancy to absorb and assimilate lime salts is exemplified by the fact that osteophytes and bony thickenings sometimes appear in the earlier months of gestation, but are absorbed as pregnancy advances, and bone begins to form in the fœtus.

The necessity of mineral nutrition in order for perfect and symmetrical growth is seen in plants as well as in human beings. The hard or osseous

tissue of a grain of wheat is its husk, or seed coat; if this be removed the phosphates are removed with it, and in the starchy part of the grain none are found. Wheat planted in earth deprived of phosphates germinates, but soon dies. Peas sown in a soil devoid of phosphates produce no flowers. (Rabuteau, 1865.)

By analogy we understand how a child, fed on food apparently nutritious, but yet lacking in phosphates and mineral matter, grows, but it grows with soft and bending bones, and teeth that rapidly fall into decay. We see this in the disease called rachitis, or rickets, a word said by Trousseau to be derived from "riquet," which in Norman-French idiom means humpbacked, or deformed. It was about 1630 that rickets was first observed as a new disease in England, and described by the anatomist Glisson. Rickets is the type of a highly-developed condition of faulty osseous and dental evolution; there is marked non-assimilation by the system of earthy salts, and soft bones and rotten teeth are the result. There is no other atrophic disease which so markedly retards the development of the teeth as rickets. The disease generally supervenes about the epoch of dentition, and, out of 346 cases noted by Dr. Jules Guerin, there were but five in which the disease showed itself after the age of five years. The bone-softening, or osteomalacia of adults, so much commoner

in women than in men, differs from rickets in the fact that it is rapid absorption and elimination of bone earth that causes the softening. In rickets it is failure of assimilation that prevents hard, healthy, bone-forming. In rickets we see softness of the bones generally, the cranial bones are soft and yielding, and the lower jaw very imperfectly developed.

The evolution of the teeth is retarded, or, if commenced, is interrupted, and when the teeth do appear they are carious and black, and soon fall from their sockets. A tendency to profuse sweating about a child's head, an overhanging, bulging forehead, marked by very evident blue veins, soreness and tenderness of limbs generally, are some of the symptoms that indicate a tendency to rickets.

Now it appears that in rickets the calcareous salts of the food are either imperfectly supplied, or, if supplied, are not taken up and deposited in the bone cartilages, and this is one element in the pathology of the disease. It is said that lactic acid present in the blood keeps the lime salts in solution, and thus they are excreted by the kidneys. Chemical analysis of the urine of rachitic children shows that it commonly contains four to six times as much phosphate of lime as is met with in normal urine, and not unfrequently the presence of lactic acid is said by Niemeyer to have been proved in this secretion. That failure in the

processes of osseous nutrition does not account for all the phenomena of rickets has been shown by Virchow; but this observer reminds us that rickets is usually preceded by a certain kind of acid dyspepsia, during which less albuminate is taken up by the system. Thus the amount of earthy salts taken up by the system is diminished, inasmuch as these are absorbed as soluble albuminates.

Virchow admits that at present this view of his is but problematical; nevertheless, I think we shall, without pursuing further the pathology of rickets, find that we have arrived at something that we can turn to practical good.

I would say, then, observe in a child whose osseous or dental tissues seem failing in their nutrition, if there be signs of acid dyspepsia; observe if the breath has a sour smell, and notice the tongue if it be coated with whitish or yellowish fur, through which red papillæ are seen pointing; see, too, if the tonsils are not unduly large; inquire about the stools, if they are irregular, pale, often lumpy, mixed with mucus, and always very sour-smelling and offensive; and, if these things be so, you will have a case where there is excess of acid in the alimentary canal, and with this condition faulty osseous nutrition is pretty sure to be associated. When inquiry is made as to diet, we may find that though the appetite is voracious, there is but little albuminous or flesh

food taken. Cornflour or starchy foods are largely consumed, and sugar is freely allowed,—just the very diet to generate excess of lactic acid in the alimentary canal. The saliva, even, may be quite acid, and it is well known that in diabetic persons, whose blood is loaded with sugar, this secretion of the glands of the mouth has been proved to contain free lactic acid,* an acid well known as a powerful solvent of lime salts. The contents of the large intestine, which are normally alkaline, become acid after excess of vegetable and starchy food, and then much mucus is secreted. This fact was noted by Lehmann in two cases of persons who had fistulæ opening from the large intestine outside on the surface of the body, resulting from the performance of the operation for artificial anus.

The recognition of this condition of acid dyspepsia and mucous irritation in young children is very important, and certainly every dental surgeon should have his eyes open to observe and detect it: for it is a condition that saps and undermines his best handiwork, and brings annoyance and vexation to parent and offspring.

I pass on to a few words as to the remedial measures. Suppose things have got so bad that the chemical analysis shows that earthy salts,

* The teeth in diabetes are singularly liable to caries.—*Quain's Dictionary.*

chiefly phosphate of lime, pass off in undue quantity by the urine, and bones and dentine are actually softening, do we cure this condition at once by simply administering lime as a remedy? The Latro Chemist, or mere chemical physician, might perhaps say yes, but in medical practice mere chemistry is not enough to lead to precision in choosing our therapeutic agents, or at any rate chemistry must be taken into account in a wide and extended sense.

To give to a big-bellied, tallow-faced child, with swelled glands, and tongue coated with slimy acid mucus, and whose large intestine is full of hard lumpy fæces, either phosphate of lime or iron will probably cause headache, feverishness, and failure; but cut off starch and cane sugar from the diet, cleanse the bowels by such an alkaline aperient as the compound decoction of aloes, and clear the blood by enjoining free exposure to fresh air, with salt water baths and diligent rubbing of the skin afterwards, and then administer some of the preparations of which I am going briefly to speak, and the patient will be brought to a condition in which the dental surgeon can work on the decayed molars with some prospect of his work remaining a long lasting proof of his skill and dexterity.

To bring about this most desirable condition the rules for diet that I find answer well are, first, to ensure slow feeding, so that farinaceous and

milky food may be thoroughly mixed with the saliva,—hence if the infant be fed with a bottle we must see that the current is not too rapid.

Bread made with malted flour is to be preferred to ordinary wheat bread, for the addition of the ground malt promotes the change of the starch of the flour into glucose, or grape sugar, and so renders it more digestible. The diastase of the malt acts like the ptyalin of saliva, by converting starch into nutritious, easily assimilated glucose.

The constipating effect of wheaten bread can be overcome by adding 1 part of barley meal to 3 of wheat flour. With regard to actual phosphatic constituents, as determined in the ash, barley and wheat do not greatly differ. For example :—

The ash of wheat yields 2·81 of lime and 49·81 of phosphoric acid.
The ash of barley yields 2·62 „ „ 38·93 „ „
The ash of oats yields 5·95 „ „ 43·84 „ „
(*Pereira.*)

Of magnesia the proportion is 12 in wheat, 7 in barley, 9 in oats. It is in the husk, or seed coat, that the mineral constituents of the grain chiefly reside : hence the advantage of having some of the husk ground up with the meal, as in the flour known as "seconds," which is in reality more nutritious than the best white flour.

Scotch oatmeal, in the form of properly made porridge, agrees well with some children, and the food is one rich in phosphatic elements, for the oats that are grown in the North appear to assimi-

late mineral matters from the soil in larger amount than those grown in the South. In cases—and these are not uncommon among delicate children—where oatmeal and brown bread appear to heat and irritate the stomach, we may administer the wheat phosphates in powder, after the method proposed by Dr. Hake and the late Dr. Tilbury Fox. A strong decoction of bran is evaporated to dryness, and the dry residue triturated with sugar of milk. The powder thus prepared can be given in milk, in doses of 10 or 20 grains, twice daily.

With regard to the special form of lime salt that is best adapted for the cure of a child whose bones show signs of softening there is a word to be said.

First we have the ordinary phosphate of lime of the B.P., made by precipitating a solution of bone ash in hydrochloric acid by means of ammonia. Thus prepared it is a soft white powder, readily soluble in hydrochloric acid without effervescence, and the dose ordered in the B.P. is from 10 to 40 grains. The probability is that of the minimum 10 grains dose, at least two-thirds would pass away by the bowels, for the books tell us that less than 5 grains of phosphate of lime is as much as the gastric juice is likely to dissolve, the remainder passing away unchanged. The phosphate of soda in the saliva, and in the gastric juice, is believed to be the agent which renders the phosphate of

lime soluble when taken as powder. In this belief some observers say that phosphate of lime has no advantage over the carbonate, for if the carbonate be taken by the mouth it is converted into a soluble phosphate, and as such is absorbed for the nutrition of the tissues.

To me it seems needless to give phosphate of lime as a powder in doses of 10 to 40 grains: it is but to fill the stomach with a considerable mass of insoluble earth, and so add to already existing irritation. If phosphate of lime be given, be content to give 2 or 3 grains twice daily, either as a powder on bread, with a grain of heavy carbonate of magnesia added, or give the phosphate in solution with a few drops of dilute hydrochloric or phosphoric acid. I have notes of the cases of children that have suffered with obstinate strumous pneumonia, swelled glands, big bellies, and pains about their bones and limbs, called sometimes growing pains, that have made excellent recoveries under the administration of soluble lime salts; and the two that I have found far the most beneficial in their action have been the soluble hypophosphite of lime and the chloride of calcium. Either one of these salts, given in doses of 2 or 3 grains with glycerine and water, appears to me to exercise a very marked action in promoting tissue growth in weak and sickly children.

The late Warburton Begbie, of Edinburgh, has

written most highly in praise of the chloride of calcium as a soluble lime salt of great value in promoting the nutrition, not only of the osseous but also of the soft tissues of the body, and I can thoroughly endorse his statements.

The lactophosphate of lime is another soluble lime salt, and under its administration the bones of animals have been found distinctly to increase in weight and strength.

Ordinary limewater (*Liquor Calcis*) contains $\frac{1}{2}$ grain of lime in each fluid ounce, and mixed with 5 parts of milk forms an excellent nutrient for the tissues. The Liquor Calcis Saccharatus is a solution of lime in syrup, so that 1 ounce contains 7 grains of hydrate of lime. In doses of 15 to 40 drops, in milk, or in glycerine and water, it is convenient and very useful. This saccharine solution of lime will often stop vomiting, and it does not appear, when given with glycerine, to have any constipating effect on the bowels. The ready solubility of lime in syrup I observe is dwelt upon by some dental surgeons as an explanation of the fact that sugar and syrup are such destructive agents to the teeth. The lime of the dentine is gradually acted upon and dissolved by the sugar.

I fear I must not trespass further on your time with any speculations as to the causes that lead to faulty nutrition generally among young children. I would only say, Is it, think you, in any

way connected with the circumstance that so many children are now brought up by hand and fed with the diluted milk of the cow? Cows' milk, as contrasted with human milk, contains 135·9 solids, to 110·9.

Salts in cows' milk	6·6;	in human milk	1·38.
Sugar	,,	38·0;	,,	43·0.
Butter	,,	36·0;	,,	26·0.
Caseine	,,	55·1;	,,	39·2.

(*Vernois & Beckerel.*)

Asses' milk is far poorer in butter and caseine than cows' milk, but richer in sugar of milk, and is closely similar in chemical composition to human milk.

Further, we should remember that in human milk the lactine, or milk sugar, diminishes in amount, while the salts and caseine increase in amount as the child grows. These are proved facts, that should be remembered by those who have the ordering of the diet of young and growing children. The nutritious caseine of milk is held in solution by a trace of alkaline salt in the milk, and is coagulated by acids and by rennet. The caseine of woman's milk is coagulated by the acid juice of the infant's stomach into light flocculi, that readily dissolve and digest. The caseine of cows' milk coagulates in the child's stomach into a compact lump of curd, not easily penetrated by the infantile gastric juice. To make cows' milk digestible it should be diluted with fresh lime-water—3 of milk to 2 of lime water, and then to

each 6 ounces of this mixture 1 teaspoonful of sugar of milk should be added.

Some recommend that the cows' milk be diluted with an equal part of barley water (Dr. Eustace Smith). If the child be costive, oatmeal tea or bran tea is an excellent diluent of the milk.

Dr. Meigs, of America, gives what I believe to be an admirable form for cows' milk. Thus :—

Let 17 drachms of milk sugar be dissolved in 1 pint of water, and mix 3 tablespoonfuls of this solution with 2 of limewater, 2 of cream, and 1 of milk. Thus will be made a nutritious, alkaline, and digestible milk, fulfilling all the conditions I have laid down for healthy nutrition of both soft and hard tissues, and not likely to be easily surpassed by any of the numerous substitutes that the ingenuity of the present day supplies for the nutrition of infants when unable to obtain the milk of the mother's breast.

Discussion.

Mr. Coleman remarked that Dr. Thorowgood's paper opened up a very interesting but also a very intricate subject. It would certainly be a great thing if some remedy could be supplied which would make good teeth; but as Dr. Thorowgood had pointed out with regard to rickets, it was one thing to supply the material which seemed to be wanted, and quite another thing to get it properly assimilated. He had met with an instance of this in keeping fowls. He had at one time some hens who would persist in laying soft eggs; he supplied them with chalk and lime in abundance, oyster-shells, egg-shells, &c., but the eggs still continued soft. With reference to Dr. Thorowgood's case of supposed cancer, he could cap it with one which had occurred in his own experience. A patient was admitted to St. Bartholomew's Hospital supposed to be suffering from cancer of the stomach. He was, however, found to be edentulous, and it was thought that his very serious symptoms might be due to imperfect digestion. Mr. Coleman was asked to supply him with a set of teeth, which he did, and the patient made a good recovery. He was surprised to hear Dr. Thorowgood say that the proportion of salts found in human and cows' milk differed so much: he (Mr. Coleman) thought that, according to Dr. Frankland's analyses, they were more equal. He should like also to ask Dr. Thorowgood if he was acquainted with the substitute for mothers' milk proposed by Dr. Frankland; it was rather troublesome to prepare, but was a very close imitation.

Mr. Henry Sewill said Dr. Thorowgood's paper opened up a wide subject, and one which had not previously been much discussed, either at their own or any of the other dental Societies. It opened up the subject of the causes of the degeneration of the dental tissues. The only criticism he

could make with regard to Dr. Thorowgood's suggestions was that he did not go quite far enough back. Perhaps the most important part of the teeth was the enamel; if this was good the quality of the dentine, although also very important, did not so much matter. But the enamel, when once formed, did not change, so that no treatment would have any effect unless it could be brought to bear whilst the enamel was being deposited. And since this was, in many of the teeth, formed at or before the period of birth, it followed that to produce any good effect the child must be influenced through the mother.

Unfortunately, but little was as yet known with regard to the causes of dental degeneration. It was known that hereditary syphilis was one cause; this would produce deformed and imperfect teeth. There was no doubt also that the administration of mercury, and the occurrence of some forms of stomatitis in infancy, would give rise to the condition known as "honeycombed" teeth; but this was about the present extent of our exact knowledge on this very important subject.

He thought that a partial explanation of dental deterioration might be found in the fact that the whole apparatus of mastication had, amongst civilised races, deteriorated from want of use, in accordance with the well-known law of evolution, that organs not fully exercised would gradually become less well developed. That the imperfect development of the teeth was not in every case due to want of lime salts was shown by the existence of well-grown people with large, strong bones, but with bad teeth. If deficiency of lime salts had, in such instances, been the cause of the bad teeth, one would have expected that the bones would be equally imperfect.

Mr. Cunningham (Cambridge) thought that Dr. Thorowgood had touched upon a very important point when, in the early part of his paper, he had spoken of the co-operation which should exist between the general and the dental surgeon. A great deal of good might be done if the dentist could only have an opportunity of treating the teeth at an

earlier age than was generally the case at present, and this was a matter in which they must depend, to a great extent, on the assistance which could be given by the family doctor. He thought also that something might be done towards extending our knowledge of the effects of therapeutic agents in improving the development of the teeth, if dental practitioners would make careful observations and experiments on members of their own families.

Mr. Stocken remarked that it was a well-known fact that a large proportion, nearly half, of the bad teeth requiring extraction were first, or "six-year-old," molars, and that the enamel cap of this tooth was formed at birth; it appeared to him, therefore, that no medical improvement could be expected in the condition of these or of the other teeth, unless by treatment of the mother during the period of pregnancy and lactation. But this fell within the province of the ordinary medical adviser, and it was to the medical profession that we must look to counteract the influences which were causing such sad results. As Mr. Sewill had pointed out, the enamel once imperfectly formed underwent no structural change for the better, and we might just as well expect a house built of faulty bricks and mortar to withstand the winds and storms of nature as to expect badly formed teeth to withstand the adverse influences to which they were sure to be exposed. This appeared to him to be the direction in which an improvement should be looked for, *i.e.*, from the medical rather than from the dental profession.

He had had an opportunity of verifying, at least negatively, the good results upon the teeth of judicious treatment during infancy in the case of one of his own children. The mother had during pregnancy suffered great trouble from the death of two elder children, and this child when born was extremely delicate. His teeth were erupted with difficulty, and at about a year old he had a very severe and obstinate attack of diarrhœa, by which he was so reduced as to necessitate his being carried about on a pillow; by careful treatment, being fed upon asses' milk, limewater and brandy, he got over this,

but about eight months afterwards had several severe attacks of spasmodic croup. Under these circumstances Mr. Stocken was very anxious as to what might prove to be the condition of the boy's permanent teeth, and determined to see how far he could assist nature in this matter. He was therefore exceedingly careful about the child's diet, giving him plenty of milk, with or without limewater, and seeing that his food generally was thoroughly digestible; besides this he took from time to time Parish's Chemistry Food. The boy was now a strong healthy young man, and with the exception of the first molars, which had been stopped, he had an excellent set of teeth.

Mr. Hele (Carlisle) said he had seen chloride of calcium given to one of his own children, who had shown symptoms of struma. The remedy, which was given before the eruption of the permanent teeth, not only counteracted the strumous symptoms, but appeared also to produce a good effect upon the teeth.

The President having called upon Dr. Thorowgood to reply,

Dr. Thorowgood said he had derived a good deal of information from the discussion which had taken place. He quite recognised the importance of attending carefully to the health of the pregnant female, and thus influencing the child through the mother. The companion case to his own related by Mr. Coleman was very interesting, but he was sorry to have to confess that he had not studied Dr. Frankland's investigations on milk: he would take an early opportunity of doing so. He was much interested also in Mr. Sewill's observation about the people met with in the northern counties with large strong bones and bad teeth. He had found the chloride of calcium very useful amongst children at the Victoria Park Hospital, not only in cases of struma, but also in chorea; it appeared to have a good effect upon the nervous system. He used the hypophosphite also extensively in similar cases. He had found it very difficult to condense his subject within the necessary limits, and had been obliged to omit a good deal of important matter; but he was glad to find, from the tone of

the discussion, that the members were evidently already alive to the importance of the question, and he hoped that in time our knowledge of this branch of therapeutics might be rendered more exact, and our means of doing practical good increased.

On the motion of the PRESIDENT, a cordial vote of thanks was then given to Dr. Thorowgood, and also to Messrs. Wallis, Stevenson, Ackery, Turner, and other contributors during the evening.

The PRESIDENT then announced that at the next meeting, on April 2nd, a paper would be read by Dr. Duckworth on "The Characters of the Teeth in Persons of the Arthritic Diathesis."

(The Meeting was then adjourned.)

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

April 2nd, 1883.

DR. JOSEPH WALKER, PRESIDENT, IN THE CHAIR.

The Minutes of the previous meeting having been read and confirmed,

The PRESIDENT said he was grieved to say that the Secretary was absent that evening in consequence of the death, after only two days' illness, of his mother, Mrs. Underwood. He was sure that all the members would sympathise with Mr. Thos. and Mr. Kew Underwood in their great and sudden bereavement.

The PRESIDENT announced that Dr. Thorowgood had presented to the Society a copy of the second edition of his work on Materia Medica.

He also announced that the following candidates for membership had been duly nominated, and would be balloted for at a subsequent meeting, viz. :—

MESSRS. RICHARD HARRISON, L.D.S.Eng., 213, Camden-road, N.;
HUGH PATERSON, L.D.S., 229, Macquarie-street, Sydney, N. S. Wales.

MR. S. J. HUTCHINSON announced that the following specimens had been sent to him by Mr. Stocken, as additions to the Museum :—(1) A wisdom tooth, having three well-developed roots and a rudimentary fourth root. (2) By way of con-

trast, a diminutive tooth which was found doing duty for a third molar,—it resembled a supernumerary tooth. (3) Models of the mouth of a patient about thirty years of age, in whom the lower temporary molars persisted. The wisdom teeth and twelve-year-old molars of both jaws were absent, and also the lower central incisors; the patient assured Mr. Stocken that these teeth had not been extracted, but had never been erupted.

Mr. Corbett exhibited, and presented to the Museum, a very large first molar which he had extracted from the mouth of a youth, aged seventeen; it measured $1\frac{1}{4}$ inch in length. Also two very large canines, extracted because they were unduly prominent; the larger measured $1\frac{3}{4}$ inch in length.

The President then called on Mr. J. Bland Sutton, L.R.C.P., to read his paper on "The Development of the Inferior Maxilla."

Development of the Inferior Maxilla.

By J. Bland Sutton, L.R.C.P., &c.

Senior Demonstrator of Anatomy, &c., Middlesex Hospital.

Concerning the development of the lower jaw of man, many opinions have been expressed by anatomists of repute, who have inquired into the subject. Some of them maintain that it arises from two centres, one for each moiety; others assert the existence of several ossific nuclei. There is sufficient explanation why such diverse statements have gained currency, from the fact that earthy matter for the lower jaw is deposited very early in embryonal time, and the various centres tend to fuse so swiftly as to give rise to the false appearance of a single centre, whilst the embryo is yet very small. These circumstances combined render accurate observation anything but an easy task.

Recently, in the course of some investigations on the development of the skull, I have had occasion to look into the mode of origin of the maxillæ, which has led me to certain conclusions which I propose to lay before this Society.

Previous to detailing my own researches into this subject it will be well to give, as a prelude, a brief history of investigations directed upon the origin of this important bone.

So far as I am able to learn, Kerckring, more than two hundred years ago, in his celebrated "Osteogenia Fœtuum" (1670), was about the first to recognise that the coronoid process possessed an independent centre. He was fortunate in possessing a goodly number of fœtuses, and spared neither time nor pains in their study.

Later, Autenrieth described the lower jaw as arising from three or four centres, one each for the coronoid process, the condyle, and a piece for the horizontal portion and angle.

Spix, in his large work, "Cephalogenesis," published in 1815, gives a brief account of the observations of previous anatomists, and not only supports Autenrieth's statement, but adds a fifth centre—a thin lamella of bone, lying along the inner surface of the maxilla, remaining as a distinct ossicle up to the fourth month. This portion is often referred to as the "piece of Spix," but as it clearly represents the splint-like bone found along the inside of the complex lower jaw of reptiles and certain fish, named the *splenial*, by that term it will be referred to throughout this paper.

Meckel, in describing the ossifications of the

lower jaw, appears to ridicule the notion of Spix, particularly concerning the *splenial* element, stating that the pretended line of demarcation is really due to the groove for the mylo-hyoid nerve. Later I will endeavour to show that this groove represents, in the most exact manner possible, the line of junction of the splenial with the dentary bone.

In the year 1821 a new interest attached itself to this region, in the discovery by Meckel of the singular rod of cartilage which bears his name. This structure was more fully described by Serres in 1822, under the name of "Maxillare inferieur temporaire." An excellent account is also give by Robin et Magitot, in "An. des Sc. Nat.," ser. iv, tome xviii, 1862. Although the Meckelian cartilage plays very little part in the development of the jaw, nevertheless it is a structure of very great morphological interest, and the modification of its proximal end has of late years occupied a considerable share of attention from several anatomists.

It was usual to state that the distal end of this cartilage atrophied, but the observations of Callender (published in "Phil. Trans.," 1869) go to show that the anterior extremity becomes ossified, forming what is termed the *Mento-meckelian* portion ;—as this is a point of some importance it will be well to go into details somewhat. Meckel,

in speaking of the mandibular symphysis, clearly states, "Sometimes between the halves of the inferior maxilla a single bone may be found, sometimes two ossicles, one on the right, the other on the left, which ultimately fuse in the middle line." It seems to my mind that this corresponds exactly to the situation of Callender's mento-meckelian ossification; the difference being that the last author describes it as an ossification of Meckel's cartilage. All that portion of the mandible anterior to the mental foramen arises in this manner.

Cruveilhier admits the existence of the *splenial* as a distinct bone, but observes that it fuses with the main portion of the bone much earlier than Spix states; my own observations accord with this.

Cruveilhier's description of this piece is very exact; he says: "It is situated on the inner side of the maxilla, its posterior extremity forming the little spine marking the entrance into the inferior dental foramen, and affords attachment to the stylo-maxillary ligament."

A more recent anatomist, Professor Humphry, considers the bone to arise usually from one centre, and that the occurrence of more than one centre is exceptional.

Renault and Rambaud, in their elaborate work, "Développement des Os," 1864, not only describe

five centres, but give the dates of appearance and fusion of the various portions.

Since this date I am not aware of any original observations on this subject, most writers contenting themselves by giving the opinions of some of the anatomists mentioned in the commencement of this paper. Consequently there was field for further inquiries into the matter.

Having given a brief *résumé* of opinions, let me now detail my observations on the subject. The examination of numerous specimens of human maxillæ, from the sixth week onward, has convinced me that the lower jaw arises from six distinct centres of ossification, five of them answering exactly to those described by Spix, the sixth representing the mento-meckelian centre of Callender.

Taking Meckel's cartilage as a keel, it is easy to raise around it a structure representing the lower jaw.

So far as I have been able to observe, the nucleus marked F in Fig. 1 is the first to appear: from this centre the larger part of the body of the bone is formed. At first it resembles a shallow trough lodging the cartilage.

The nuclei for condyle, coronoid, and angle follow so rapidly that it is difficult to determine their order. About the same time osseous granules may be seen in the perichondrium surrounding

the distal end of Meckel's cartilage, gradually invading its substance.

As soon as the various centres make their appearance, a thin network of osseous tissue quickly connects them. When this occurs, a thin shelf of bone will be found immediately above Meckel's cartilage and the inferior dental nerve. This latter osseous streak lies on the inner side of the developing bone, quite distinct from the other centres, and represents the splenial. Now is the very best time to observe the various nuclei. particularly if the bone be rendered transparent by means of alcohol and oil of cloves. Its appearance is very striking. The bone presents the familiar shape of the fœtal jaw, but its texture reminds one of a spider's web, the various centres showing like flies entangled in the mesh (Fig. 1).

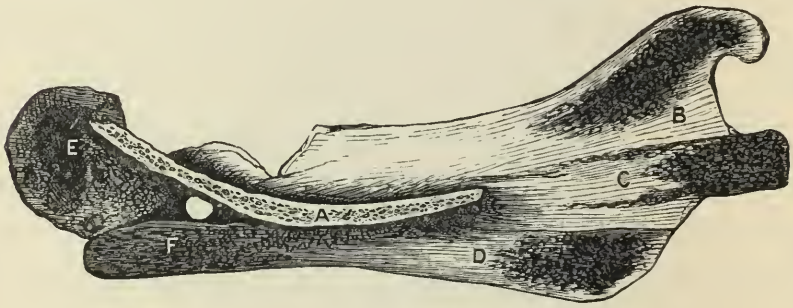


FIG. $1 \times \frac{10}{1}$

Represents the lower jaw of a human fœtus at about the tenth week of intra-uterine life. All the centres have made their appearance.

E. Mento-meckelian.
F. Dentary.
A. Splenial.
B. Coronoid.
C. Condyle.
D. Angular.

The order of events may be arranged in stages, for the sake of clearness, thus :

1st. Meckel's cartilage appears.

2nd. Dentary is seen below.

3rd. Centres for condyle, coronoid, angle, and mento-meckelian.

4th. Network of osseous tissue connects them together.

5th. Splenial appears as ledge of bone supporting teeth.

6th. Disappearance of Meckel's cartilage from jaw, and fusion of splenial.

The splenial element is interesting on account of its relation to the developing teeth.

On the first appearance it stands out at right-angles to the dentary, serving to separate the teeth germs from Meckel's cartilage. If at the fourth month of intra-uterine life the tissues on the inner side of the jaw be carefully dissected away, the splenial will be observed forming a distinct ledge of bone, supporting on its superior surface the dental follicles, like flasks upon a shelf; immediately beneath it runs Meckel's cartilage and the nerve. As the cartilage atrophies, the splenial extends downwards to fuse with the dentary immediately below the nerve; in this way the mylo-hyoid branch gets shut off from the main portion of the inferior dental nerve (Fig. 3). After the fourth month it extends vertically to form the

inner wall of the maxilla, all trace of its originally separate condition being thus completely lost, the bone then assuming the condition which it presents at birth, and with which we are all so familiar.

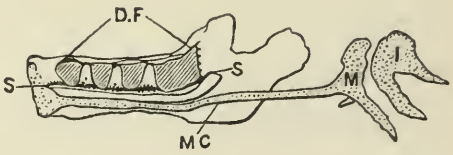


FIG. 3 × $\frac{1}{3}$

Human lower jaw at end of the third month of intra-uterine life. Designed to show the relation of the splenial element to the dental follicles and the meckelian cartilage. I. Incus. M. Malleus. MC. Meckel's cartilage. S. Splenial. D.F. Dental follicles.

Let me now offer evidence of the compound nature of this bone of a different character.

In the year 1819 the celebrated French anatomist Serres propounded in a paper read before the Académie des Sciences, Paris, certain laws bearing on ossification; among them was one termed the "Loi de conjugaison," by which he showed the various foramina in bones to result from the apposition of two or more distinct bones, or distinct centres of ossification. To this law there were many exceptions; among the more notable were certain foramina in the temporal bone, and the inferior dental foramina.

An excellent example of the law is the mode of formation of the anterior palatine foramen; the

foramen in each superior maxilla is formed by the coalescence of the premaxillary with the body of the bone and the palate process; whereas the hiatus as seen from the hard palate, is formed by apposition of the maxilla of opposite sides.

When I first took up the subject of nerve foramina, Serres' researches were quite unknown to me, and I took as my guide this rule: "*Whenever a nerve passes through a bone it marks the confluence of two or more ossific centres.*" Among the earliest bones to yield under this method of analysis were the temporal and inferior maxilla; later I became acquainted with Serres' paper, the greater part of which is published as a footnote in the French traduction of Meckel's "Anatomie Comparée, vol. iv." Much to my satisfaction I found that my method had yielded far more satisfactory results, and had banished two of the apparently most obvious exceptions to the law; and it is most interesting to trace out the intricate pathways by which many nerves quit the cranial cavity in order to avoid piercing an ossific centre. Applied to the lower jaw the rule stands thus: the nerves concerned are the inferior dental, mental, and mylo-hyoid. The inferior dental enters by the foramen of the same name, formed by the coalescence of the coronoid, condyloid, dentary, angular, and splenial elements (Fig. 2); the nerve then travels in a tunnel formed on the outer side by

the dentary, and the inner side by the splenial. The mental branch passes out through a fenestra formed by dentary and mento-meckelian ossifications.

The mylo-hyoid runs in the groove which once lodged Meckel's cartilage, the sulcus also corresponding to the junction of splenial with dentary (Fig. 2).

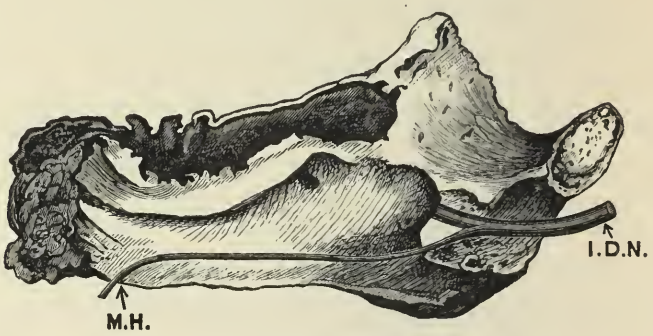


FIG. 2 × 1½

Lower jaw of fœtus at term. To show the relation of nerves to the bone.

As the inferior dental passes along the canal it sends up twigs to the teeth, which twigs occupy foramina or spaces left between the splenial and dentary.

The relations of nerves thus lends additional help towards unravelling the mystery.

So far, the inquiry has been conducted from the standpoint of human osteology. What aid does comparative anatomy lend? My answer is, it sheds light of the purest kind.

Examine first a common dogfish: the lower jaw consists simply of a rudely-fashioned piece of carti-

lage covered with skin, bearing teeth. This cartilaginous bar articulates with the palato-quadrate arcade, and by means of a ligament is fixed to the hyomandibular cartilage (see Fig. 4, M).

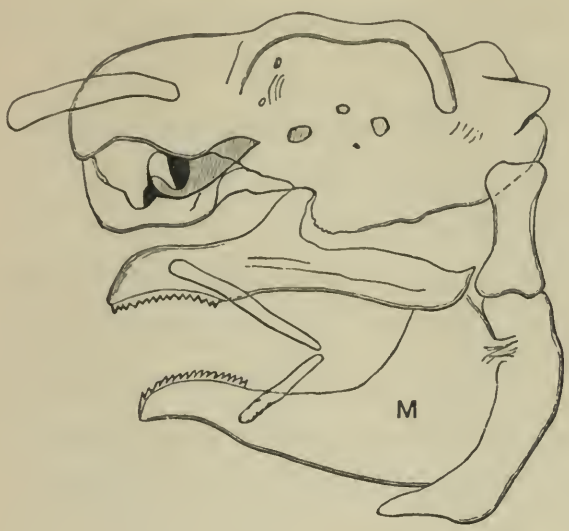


FIG. 4.
Skull of Dogfish.

Turn to the sturgeon. The mandibular cartilage persists, surrounded by an ossification representing the dentary; the anterior extremity of the cartilage is tipped occasionally by a small ossification representing the mento-meckelian, and a small angular ossification is present.[1]

The singular ganoid *Amia* possesses a very complex mandible.[2]

In this interesting fish Meckel's cartilage is pre-

[1] Parker and Bettany, "Morph. of Skull," p. 84.
[2] Bridge, *Amia*: "Journal of Anatomy," vol. xi.

sent as a thin axial band, having a small ossicle at its distal end representing the mento-meckelian.

Splenial and dentary elements are met with on the inner and outer sides respectively. The articular portion is formed by the confluence of three distinct ossicles, angular and surangular being also represented.

In teleostean fishes not only is the lower jaw compounded of several distinct bones, but its suspensorium is complex also.

Choosing as an example the skull of the cod, a chain of bones is found, extending from the skull to the mandibular articulation, named from above downwards: Hyomandibular, symplectic, and quadrate. The bones forming the mandible in the

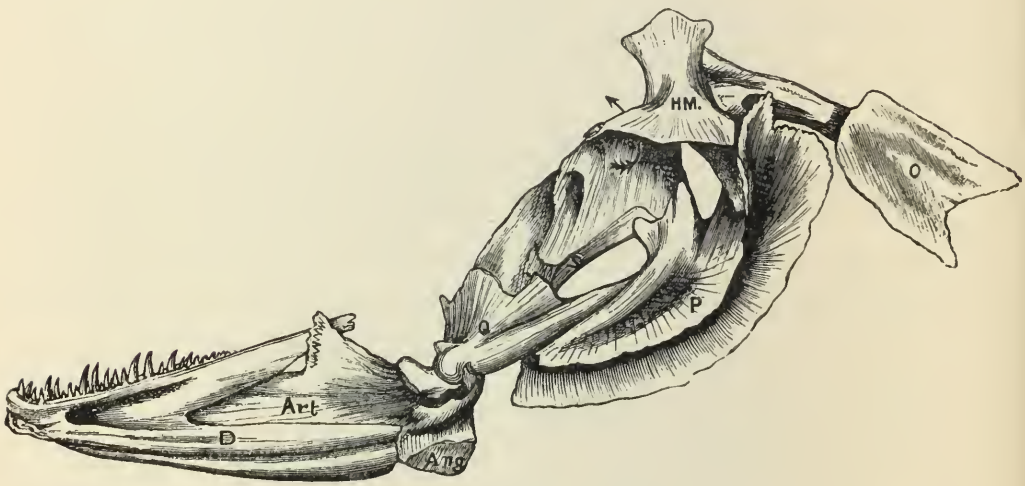


FIG. 5.

Suspensorium and Mandible of a Cod.

HM. Hyomandibular.	Ang. Angular.
S. Symplectic.	D. Dentary.
Q. Quadrate.	O. Operculum.
Art. Articular.	P. Præoperculum.

adult fish are reduced to three—dentary, articular, and a small angular; Meckel's cartilage persisting from the articular forwards to the symphysis (Fig. 5).

I feel very suspicious that the remaining elements, mento-meckelian, supra-angular, and splenial, are present also, but fused to the dentary; but inability to obtain embryoes prevents me verifying my suspicions on this point.

The same elements can be traced through amphibian and reptilian maxillæ up to mammals. Once within the mammalian circle the complex mandible, so characteristic of creatures lower in the scale, disappears, and the entire series of mandibular bones is represented by the single bar of bone characteristic of mammals. The remarkable modifications these parts have undergone renders homological interpretation difficult and uncertain.

More than forty years ago Reichert endeavoured to show that the auditory ossicles were the representatives in man of certain of the bones forming the suspensorium of the mandible of the fish. The subject was taken up in this country by Professor Huxley, who endeavoured to show that the quadrate and articular bones of the fish are the homologues of the incus and malleus. In the first place he considered the incus as representing the quadrate, and malleus the articular. This was in 1864. Two years later Peters of Berlin gave a new inter-

pretation of the matter, which led Professor Huxley to reconsider the whole subject; the result of this reinvestigation is published in "The Transactions of the Zoological Society," 1869, in the well-known paper, "The Representatives of Malleus and Incus of Mammalia in other Vertebrata." Here it is shown very conclusively that the representative of the quadrate bone in fish and reptiles is found in the malleus. This view has recently been confirmed by the observations of Fraser, in a communication to the Royal Society, in 1882, on the "Ossicula."

This is an important point, for if the quadrate of fish, &c., is represented by the malleus in mammals, what has become of the various elements forming the complex mandible of the creatures below them? Is it not more than probable that they should be represented by distinct ossific nuclei in the lower jaw of man and mammals, judging from what is known with regard to the development of other bones forming the complicated human skull? Let a line be drawn through the articulation of the quadrate with the articular bone in the fish; such a line would correspond with the glenoid fossa of man's skull; then one would expect to find representatives in the two cases below this line, for there is nothing to point to arrest of parts.

The following table represents what I believe to be the homologies of the various centres and bones

under consideration, where it will be noted that all bones on the inner side of the maxilla are considered to belong to the splenial; the bone termed surangular I hold to be homologous with the coronoid process of Anthropotomy, because it is situated to the outer side of Meckel's cartilage and the inferior dental nerve, thus corresponding in position, and in its relation to the articular bone, as the coronoid of the human maxilla does to the condyle.

Homo.		Fish, &c.,
Mento-meckelian	=	Mento-meckelian.
Angle ..	=	Angular.
Condyle ..	=	Articular.
Coronoid ..	=	Surangular.
Splenial ..	=	Splenial.
Dentary ..	=	Dentary.

Thus actual observation, reinforced by the application of theory, and rendered more than probable by appeal to Comparative Anatomy, support the view of the compound nature of man's inferior maxilla.

Discussion.

Mr. Gaddes said he was sure he should be expressing the general feeling of the meeting when he assured Mr. Sutton that they felt greatly indebted to him for the valuable and interesting paper they had just heard. He had himself made some slight attempts to investigate this question, though without obtaining any very striking results. He should like to ask Mr. Sutton whether he thought Meckel's cartilage took any part in the ossification of the maxilla beyond the formation of the mento-meckelian centre? So far as his own observations went the cartilage appeared to become into fibrous tissue.

Mr. Chas. Tomes said Mr. Sutton's paper was not one which could be profitably discussed off-hand; it dealt with some rather recondite questions, and required thinking over. It was scarcely fair to criticise such a paper after hearing it once read, else the impression produced upon his mind was that Mr. Sutton was disposed to attach rather too much importance to the centres of ossification. Instances could be given in which independent centres of ossification existed, and yet were not known to be of special morphological importance. He thought, therefore, that his argument with regard to the homologies of these parts would be stronger if more stress were laid upon their relations to the nerves and to one another, and less on the fact of their separate origin.

Mr. S. J. Hutchinson remarked that he had never before heard a recondite question so clearly explained and made so generally interesting. He felt that he had learnt something that evening, but should still be glad of a little further information. He understood that the outer plate of the bone was formed by the union of the centres which first appeared; then

the splenial appeared inside and at right angles to this, and from the inner side of the splenial a down growth was given off which enclosed the inferior dental nerve. This accounted for the greater part of the bone, but he should still be glad to know how the internal alveolar plate was formed?

Mr. Sutton, having been called upon to reply, said he should like to know what was the age of the fœtus on which Mr. Gaddes had tried to investigate the ossification of the lower jaw? (Mr. Gaddes, "Three months.") That was about a month too late; the process of ossification was then too far advanced to allow of the separate origin of the various parts to be distinguished. The mento-meckelian centre originated in the perichondrium surrounding the anterior extremity of Meckel's cartilage, but beyond this it did not take any part in the formation of the bone.

With reference to the criticism of Mr. Tomes, he could only say that he believed that further consideration would convince Mr. Tomes that these centres of ossification were really of very great morphological importance. It was found, for instance, that the petrous part of the temporal bone, dense and solid as it appeared when complete, was at an early period of its growth split up into five pieces, and that each of these centres had as its homologue a bone in the skull of the fish. And so also, as he had endeavoured to show, the various centres from which the lower jaw was formed had their homologues in the compound jaw of fish and reptilia.

In reply to Mr. Hutchinson's question, he would explain that when the splenial portion was formed inside the outer part of the body of the jaw it had the dental follicles above it, and Meckel's cartilage and the inferior dental nerve below. After a time a growth of bone took place from the inner margin of the splenial, which, extending downwards, united with the outer plate and shut in the inferior dental nerve, and growing upward formed the inner alveolar plate and the sockets of the teeth.

The President said he most thoroughly agreed with the remarks which had been made by Mr. Gaddes and Mr.

Hutchinson with reference to the valuable and interesting nature of Mr. Sutton's paper. He understood that Mr. Sutton was then engaged in investigating the process of development and the homologies of the upper jaw, and he hoped that when his researches were sufficiently advanced he would bring them before the Odontological Society. He begged to thank him heartily in the name of the Society for the paper he had read that evening.

The PRESIDENT then called upon Mr. Coleman to read his paper on "Spontaneous Fracture of the Teeth."

On the Spontaneous Fracture of the Teeth.

By A. Coleman, F.R.C.S.

Under this designation I venture to include those cases in which fracture or splitting of the teeth occurs without any apparent assignable cause. Such cases have from time to time been brought under the notice of this Society, but have never, so far as I am able to find out, been described in any of the works on Dental Surgery. Even Wedl, who has collected such a vast amount of information in regard to all abnormal conditions and affections occurring to the teeth, fails to record or describe any such as this.[1]

[1] Since this paper was printed my attention has been called to a passage in an excellent paper by Dr. Arkövy, on "The Relations of Pathological Concretions of the Tooth-Pulp to Prosopalgia (Tic Douloureux)," published last year in the "Journal of the British Dental Association" (July and August, 1882). Dr. Arkövy says: "There is, it is true, a form of pulpitis occurring in outwardly sound teeth which, according to some authors, is due sometimes to internal caries, *and sometimes it occurs in conjunction with* (*or as the result of*) *bursting of the teeth* ('zahn-explosion'); but the descriptions are so obscure, and the particulars so unreliable that these cases cannot yet be unreservedly accepted." Dr. Langmore, who kindly called my attention to the above reference, informs me that when this paper was in process of translation, he wrote to Dr. Arkövy asking for some explanation of this passage, especially as to the meaning of the term "zahn-explosion," but the author, in reply, only gave a reference to the "Vierteljahresschrift für Zahnheilkunde," April, 1868, p. 146, intimating that he himself had no personal knowledge of the cases referred to, and that the description given was not as clear as could be wished.

The history of these cases may be well gathered from the record of communications made to this Society at the May meeting of last year. "Mr. Sewill handed round a card on which the following specimens were mounted :— . . . "(3) a lower molar, which looked as if a longitudinal section had been made through one of the roots, the crown being intact. The tooth presented exactly the same appearance when first extracted. Mr. Sewill at once explored the alveolus for the missing fragment and extracted it. The patient had not met with any accident, and no cause could be assigned for the fracture."

"Mr. F. H. Weiss said that Mr. Sewill's third specimen reminded him of a patient who came to him complaining of tenderness and neuralgic pain in the second right upper bicuspid. The tooth appeared at first sight to be sound; there was no caries, but closer inspection revealed the fact that it was split for about two-thirds of its length. The patient was quite unaware how the accident had happened."

"Mr. F. Canton said a lady once came to him complaining of pain in an upper bicuspid. He examined it carefully, but could not find much the matter with it. Eighteen months later the patient

I have not had an opportunity of referring to the periodical named, but I should suppose that by "zahn-explosion" is meant the supposed splitting of teeth by gases generated in their pulp cavities.

returned, saying that the tooth continued very sensitive; the line of fracture was then quite evident, and he extracted the tooth. But the patient could not tell in the least how it had been broken."

"Mr. Stocken mentioned the case of a gentleman who had applied to him twice on account of similar fractures,—first of a first, and then of a second lower molar; the latter was split right down to the very end of the fangs."

"Mr. Steel said that a few years ago an old lady, about seventy years of age, applied to him on account of pain in a molar, which had been stopped with gold by Mr. Cartwright forty years before. The tooth and stopping appeared quite sound, but it was so painful that he extracted it, and then found that it had been broken in half; the line of division could not be distinguished whilst the tooth was *in situ*. The pulp was alive."

The cases I have met with, some five or six in number, could be almost described in the very words of the above.

The first occurred many years ago when I was quite a beginner, and distressed me not a little. The offending tooth was a lower molar: it had a small, not deep, carious cavity on the anterior aspect, and of the black variety. As the tooth had been long very painful and tender to bite

upon, I determined to extract it, but on placing the forceps upon it and pressing them down, the crown came away with a slight snap. The remainder of the tooth appearing free from sensitiveness—the pulp being calcified, though dark coloured—I determined to leave it and watch the result, but I never saw my patient again. The crown, which I kept for several years, but have unfortunately lost, appeared to have been split horizontally nearly across, but there were evidences that the forceps had completed the work.

The next case I will mention came under my hands some thirteen or fourteen years ago, in the person of a gentleman, possessing one of the most excellent sets of teeth I have, perhaps, ever seen, and who has been so good as to contribute in his own person several matters of considerable interest in dental surgery; thus, in addition to the above, he has furnished me with the best examples of exostoses of the maxillæ I have ever seen, and at the age of eighty-six obligingly erupted a third molar.

This gentleman came to me complaining of pain and discomfort, especially when eating, in an upper molar of the right side. There was no appearance of any other detriment to the tooth, except that the masticating surface was somewhat worn, and had received a small, pin-hole gold-filling, beautifully executed by Mr. Cartwright, *secundus*. I

recommended sal volatile, having found that a useful local remedy in exposed sensitive dentine. I saw the tooth from time to time, and on the last occasion found it split diagonally in the antero-posterior direction. I removed the smaller fragment, slightly attached to the gum. The pulp was dead, but had undergone considerable calcification. The only history of violence was here the filling of the tooth.

Another case which I will mention occurred within the last two years. A large fragment of an upper bicuspid came away without any accountable reason, and left an exposed pulp, which I destroyed with some difficulty, owing to the amount of calcification.

The last case I will describe occurred in the person of an army surgeon, who possesses a magnificent set of teeth. He came to see me last autumn, on account of a lower right first molar, which had for a long time been a source of annoyance to him, especially in mastication. Some two or three months previous he had consulted Mr. Ewbank, who could detect nothing wrong with the tooth. It being slightly worn on the surface, I recommended the application of sal volatile to the crown of the tooth, and a saturated solution of Ammonii Chloridi to the surrounding gum, which I have found very serviceable as a counter-irritant in cases of irritable (hyperæmic?) pulps. My

colleague, Mr. Lyons, who saw the case with me—it was at St. Bartholomew's—could detect nothing wrong with the tooth. A month or two later he returned, and there being now severe periosteal mischief, I determined to remove the tooth. With this object gas was administered by Mr. Mills, but on applying the forceps, with the minimum of force, the tooth fractured. I removed one root, but before I had time to remove the second the patient had recovered, and I therefore left it. When fresh, the tooth showed distinctly an old split, or cleft, running down to the pulp, which was dead, but which had undergone considerable calcification. When seen previously I can confidently assert there was not the slightest appearance of any cleft or crack. Here, again, there was no history of violence or accident that could have caused a fracture.

During the record of cases at the May meeting of the Society in last year no explanation was offered for these occurrences; but on a former occasion I distinctly recollect that they were accounted for by the generation of gases within the pulp cavity, which, by expansive force, split open the tooth. This explanation always appeared to me a very unsatisfactory one, for, even admitting that the apical foramina could be so occluded that gases could not pass out of them, the splitting of a tooth from such a cause could hardly be

unattended with marked and very disagreeable symptoms. Moreover there were the cases where a living pulp existed.

Upon the cause of these splittings I had formed some conjectures, and these were strongly confirmed upon seeing the specimen exhibited by Mr. Sewill, and when it was pointed out to me by Mr. Henri Weiss, that a considerable calcification of the pulp had taken place. I therefore venture to assert that these cases of spontaneous fracture occur through a calcification of the dental pulp, accompanied with an enlargement of the same during that process.

But it may be said calcification of the pulp is a normal condition, occurring in teeth much used, and in persons past the middle age. All healthy teeth removed late in life give evidences of it. If teeth in which it is in progress be removed, we often, perhaps generally, find calcospherites, and which, as a rule, cause no discomfort to their possessors. How is it then that, in some cases of calcification of the pulp, we get such intense pain that in order to account for it we are driven to the conclusion that there is a pressure resulting from it upon some sensitive surroundings. At the November meeting of last year I described a case of perfect calcification of the pulp of an upper central incisor; the tooth had never caused the slightest pain. My report was immediately

followed by a similar one from Mr. Redman, but in this case "the lady to whom it had belonged had suffered for a number of years from most severe attacks of pain, which she referred to this tooth."

I trust the explanation I shall offer may not be considered too theoretical to propound before a Society like this. I imagine that in these painful cases the pulp has, prior to calcification, been in an hyperæmic condition—a condition in which it possesses a tendency to hypertrophy, and where, had it been exposed by caries, it would have augmented itself as a polypus. Now calcifying in this condition an expanded mass results, which, pressing upon any portions of remaining living pulp, gives rise to neuralgia; but where no living pulp exists it exerts its pressure upon the surrounding dentine, which highly-elastic body reacts upon the cementum and produces a like result.[1] This explanation, it occurs to me, will also satisfactorily account for those cases in which pain is experienced in well-filled teeth some time after the operation has been carried out. I will mention two such cases which have come under my observation within the last two years. The first, a gentleman about twenty-

[1] The teeth, together with the bony tissue partially investing them, have a high degree of elasticity, in consequence of which they may be subjected to marked compression and still return to their previous condition upon the removal of the source of the latter; these physical properties appertain to the *dentine* in particular, which, in addition to a solid structure, presents a delicacy of texture that admits of a high degree of tension.—"Pathology of the Teeth," by Carl Wedl, M.D., p. 30.

two years of age, applied to me in consequence of continual wearing pain, and acute pain when exposed to heat and cold, in a lower second molar tooth having a large filling on the masticating surface of amalgam, probably Fletcher's platinum. The filling had been admirably carried out and finished off. As a guarantee of this I need only mention that it was the work of Mr. Roberts, formerly of Ramsgate. It had been done four or five years, and had only recently caused him trouble. Chloride of ammonium in solution applied to the gum afforded some relief, but the pain increasing, he solicited the removal of the tooth. This I declined to do, but I drilled through the stopping, expecting to come down upon a devitalised pulp, but came upon very sensitive dentine, perfectly sweet. I enlarged the opening considerably, and then filled up with gutta-percha, the pain and tenderness quite disappearing. The other case occurred late in last summer, the tooth was an upper wisdom, and filled with phosphate of zinc cement. There were the like conditions, and the same cessation of pain following the same treatment.

Now I apprehend that in these cases there occurred a calcification of the pulp with enlargement, and that the thin layer of dentine situated between this and the filling was elevated, and thus pressed against the latter. By the treatment the pressure was removed.

Discussion.

The President said he had met with five or six cases of such fractures as Mr. Coleman had described, but the explanation which Mr. Coleman had suggested certainly had not occurred to him, and he was scarcely prepared to accept it now it was put forward. He believed that they were due to some external violence; in three of his cases this certainly was the cause. Thus in one instance the tooth was broken by biting on a small stone, and in another the outer wall of the tooth was split off without exposing the pulp cavity, which could not have occurred had the cause been expansion from within the cavity.

Mr. F. H. Weiss said he did not remember that the pulp was calcified in the specimen he had referred to at the meeting in May last year, but as he had presented the tooth to the Museum it could probably be examined and this fact ascertained.

Mr. Stocken said that with regard to the cases he had mentioned at the meeting in May last year, he might at once state that in both instances the fracture was due to violence. In one case the fracture was not through the pulp cavity at all; in the other the pulp cavity was opened, but the tooth was much worn, and was certainly broken by concussion.

Mr. Chas. Tomes said he could relate a case which showed the length of time a fracture might exist without causing any symptoms. A medical friend of his was leaning forward in his carriage when the coachman pulled up very suddenly, and the doctor's chin came forcibly in contact with the fore part of the carriage. He suffered no ill effects at the time, nor for nearly two years afterwards; he then began to be troubled with severe neuralgia up one side of his face, together with

some uneasiness, not amounting to pain, in an upper molar. On very careful examination Mr. Tomes found that this tooth was split completely in halves, the palatine root being attached to one fragment and the labial roots to the other; the edges were in such close adaptation that the fracture was only visible on very close inspection. The pulp was alive, and only a little sloughy on the surface. In this instance there was no doubt as to the cause of the accident, although it had only been detected two years after its occurrence; and he would suggest that mechanical violence might have been the cause in other cases also, but that, as no symptoms occurred at the time, or perhaps until long afterwards, the original cause of the accident might easily be forgotten.

Mr. F. J. Bennett remarked that fracture of the teeth might sometimes occur from slighter causes than might be supposed. Thus a gentleman whom he knew split one of his bicuspids whilst eating a captain's biscuit, and the following year broke another bicuspid in the same way. In elderly people the teeth became more brittle, just as the bones did, and then, some being lost, the others received less lateral support, and became exposed to more severe concussion.

Mr. S. J. Hutchinson said he also was quite unable to follow Mr. Coleman in his explanation of the cause of these fractures. Calcification of the pulp might occur in two ways, viz.: by conversion of the peripheral portion into secondary dentine, in which case there would be simple conversion of the odontoblasts, and no enlargement could occur; whilst in the other there was deposit of lime salts in the soft tissues of the pulp, attended by atrophy of other portions, also a process which could scarcely be attended by such enlargement as forcibly to split the tooth. Even supposing the whole of the pulp to be calcified into a calcospherite, so as to exactly fill the pulp cavity, where was the pabulum to come from which could afterwards increase the contents so as to create an expansive force?

His own opinion was that the accident was always due to some form of external violence. In confirmation of this view

he might refer to a case, recorded about two years ago for the "Journal of the British Dental Association," under the title, "A cracked tooth as a cause of neuralgia." A lady, unfortunately an inebriate, had suffered from facial neuralgia and pain in a bicuspid tooth for eighteen months. He found, on very careful examination, that it was cracked, but not actually broken, through the crown right into the pulp cavity, and no doubt had been in this condition for at least the time mentioned.

He would suggest that the calcification which Mr. Coleman had said was so constantly met with in these cases was not the *cause* of the fracture, but a *result* of it. That it was, in fact, due to the irritation set up in the pulp by the existence of the crack which afterwards resulted in fracture.

Mr. Storrer Bennett said he had not himself met with any cases similar to those described by Mr. Coleman, and had therefore not been led to give any special attention to the subject, but he could not think that the explanation given by Mr. Coleman could be accepted. The calcification of a tooth pulp did not occur suddenly, like the solidification of water into ice. It was essentially a slow process, and supposing any enlargement to occur at first during the turgescent stage spoken of by Mr. Coleman, the hard mass would only compress, and cause atrophy of, the soft uncalcified portion of the pulp. He would not himself attempt to say what the real cause of the accident might be, but he thought some more probable explanation must be found than that suggested by the author of the paper.

Mr. Hern said he could relate a case strongly confirming the view which Mr. Chas. Tomes had taken with regard to the origin of these cases. A man applied at the Dental Hospital in February or March, complaining of facial neuralgia. On careful examination it was found that one of his upper first bicuspids was fractured in an antero-posterior direction. It was then ascertained that in the previous September he had fallen out of a window, but he was quite free from pain for two months after this, and had never suffered

much from the tooth itself. It was extracted, and was found to be split, not only longitudinally but also transversely.

Mr. J. Bland Sutton said he had not as yet given special attention to the pathology of the teeth, but looking at Mr. Coleman's explanation from the point of view of general pathology he could only say that the suggested course of events was something quite novel. The effect of the continuous pressure of one part on another was to cause either absorption or expansion, or both; but he did not know of any instance in which fracture could be thus caused. Thus in the case of a tumour growing within a bone it would expand it and thin it to a mere shell, but the occurrence of fracture independent of external violence was unknown.

Mr. Coleman said he had at the commencement of his paper expressly stated that he excluded cases of fracture from violence. Such cases were common enough, and no doubt they were more apt to occur in persons of advanced age. It could not be denied also that teeth might be cracked or broken, and the fact not be detected at the time. But he was of opinion that cases did occur in which no such cause could be assigned. The occurrence of such cases had been noted by various observers, and the fracture had been thought to be due to the collection of gas in the pulp cavity.

The process of calcification to which he referred was not closely connected with the odontoblast layer, but proceeded irregularly in the pulp, and his suggestion was that under certain circumstances, when the pulp was in a state of congestion, the calcareous deposit might take place in excess, and thus come to exert an expansive force on the walls of the pulp cavity. At all events this class of fractures appeared to be invariably connected with calcification of the pulp, and it seemed natural to conclude that this might have something to do with their causation.

With reference to Mr. Sutton's remarks, he could only say that the comparison between a hard growth in a pulp cavity and a tumour in bone did not apply. Absorption of bone would occur readily, whilst, owing to the greater density of

the tooth structures and the difference in the vascular supply, pressure from within could not be relieved thus easily.

The PRESIDENT, having thanked Mr. Coleman for his paper, said that Dr. Dyce Duckworth had unfortunately been unable to read his paper that evening, as had been at first arranged, owing to the occurrence of a severe bronchial attack, but he hoped to be able to do so at the meeting on May 7th.

(The Meeting was then adjourned.)

ERRATUM.

In Dr. Thorowgood's paper, in March number, page 142, line 5, *for* Latro Chemist *read* Iatro Chemist.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

May 7th, 1883.

DR. JOSEPH WALKER, PRESIDENT, IN THE CHAIR.

The Minutes of the previous meeting having been read and confirmed,

MR. F. CANTON exhibited a lower second molar, having a carious cavity in the crown, and showing considerable absorption of the neck on the posterior aspect. One of the students at the hospital was clearing out the cavity with a drill, the nerve having been destroyed, when the instrument suddenly went through the side of the cavity, below the gum, and came upon enamel. The tooth was then extracted, and it was found that the enamel on which the drill had struck was the crown of the wisdom tooth, which was lying horizontally, and which had by its pressure caused a very considerable amount of absorption of the adjacent tooth below the carious portion, and quite unconnected with it. The patient did not appear to have suffered any particular pain, and there had been no special symptoms pointing to this condition of things.

Soon afterwards, another case of impacted wisdom tooth came under his notice, in which an abscess had formed. In this the second molar was extracted because it was found impossible to remove the wisdom tooth without doing so. On looking at the second molar, it would be seen that absorption had taken place in this case also, though to a much smaller extent—in fact, it was only just commencing.

Mr. Ackery said that about a fortnight after the occurrence of Mr. Canton's case, a very similar one came under his notice in private practice. The tooth was an upper second right molar: he came upon the wisdom tooth whilst excavating a cervical cavity. The root just below the cavity had been absorbed almost into the canal by the pressure of the cusp of the wisdom tooth. One point in the case was that impacted wisdom teeth were rather rare in the upper jaw.

The President remarked that impacted wisdom teeth were not an uncommon cause of obstinate neuralgia, and such cases were sometimes very puzzling. He remembered one case in which all sorts of treatment had been tried for three years, and which had baffled the skill of several eminent medical authorities. He extracted the second molar and the patient was at once relieved.

Mr. Coleman said the most puzzling case of the kind which he had met with was one in which severe neuralgia was caused by the pressure of a supplementary wisdom tooth on the third molar; such a state of things was, of course, exceedingly rare.

Mr. Dewes read notes of a case which had occurred in the practice of Dr. Chas. R. Williams, of Ashby-de-la-Zouche, in which a portion of an upper set, consisting of gold plate with two molars attached, had been accidentally swallowed. The patient, a young woman, had noticed several days before that there was a crack in the plate (an upper set) between the first and second molars on the right side, and had it temporarily repaired by a dentist, who told her, however, to be very careful in eating until it was more securely mended. She therefore avoided all food that required much mastication, and when the accident occurred was eating a soaked crust and talking to her sister. All at once she felt a sharp pain and a lump in her throat, and found that two of the teeth were gone. She tried to get them up but failed. Then vomiting set in of glairy matter mixed with blood, and she felt the lump gradually getting lower, "as if it was cutting its way down." When Dr. Williams arrived, half-an-hour

after the occurrence, the vomiting had ceased; the patient pointed to the chest opposite the lower end of the gullet as the point at which she felt the teeth, and where they gave rise to sharp pain. Dr. Williams passed a probang very carefully down the œsophagus, and felt the plate low down; he tried to get the instrument beyond it, but did not succeed, and the teeth fell into the stomach. The patient at once felt great relief. Dr. Williams gave strict orders that she was not to take any aperients. For two days she could only take liquid food, owing to the painful state of the pharynx and œsophagus; on the third day she was able to take thick porridge, &c., and on the following morning, when the bowels were moved, she was gratified to find the missing teeth in the motion. During the interval the patient only once felt a colicky pain in the bowels, and a pricking sensation as it passed the anus.

Mr. Henri Weiss remarked that when his father, a few years ago, brought this subject before the Society, he recommended the adoption of a plan of treatment which had proved successful in several of the recorded cases which he collected together. It consisted in administering to the patient thick porridge into which a quantity of chopped worsted had been stirred. It was found that the worsted became entangled with any hooks or sharp points of the plate, and, by thus covering these more dangerous parts, protected the stomach and intestines from injury.

Dr. Duckworth said one of his colleagues at St. Bartholomew's Hospital, Mr. Thomas Smith, had long been in the habit of ordering patients who had accidentally swallowed foreign bodies to take oatmeal porridge in which chopped up cotton wool had been mixed. This plan of treatment had been found very successful.

Mr. Dennant said that some years ago a case very similar to that just described by Mr. Dewes had occurred in his own practice. A servant girl came to him in great alarm at having swallowed a plate with three teeth attached. He recommended a diet of suet pudding, &c., but no aperients, and a

day or two later the girl returned bringing the plate, which had passed through the bowels without giving rise to any inconvenience.

Mr. Oakley Coles showed, for Mr. Smith Turner, models of the mouth of a lady, aged twenty-nine, in whom the bite had been perfect until three or four years ago, when difficulty began to be experienced in closing the teeth properly, and this had increased until now there was an interval of a quarter of an inch between the upper and lower incisors when the jaws were closed. The change appeared to have been coincident with the eruption of the wisdom teeth, which had in the process of eruption displaced those in front. Mr. Turner would be exceedingly obliged to the members if they would state their opinions as to the best course to be adopted with the view of remedying this state of things.

Mr. Williamson (Aberdeen) said that he had met with a similar case some years ago in his own practice. The patient was a young clergyman, who complained especially that the inability to close his jaws had caused a peculiar alteration in his voice. Mr. Williamson extracted the two upper wisdom teeth, and considerable improvement followed, though the normal relation of the parts was not altogether restored.

Mr. Coleman said he had met with a troublesome case in which the bite was spoilt by the removal of two bicuspids on one side and one on the other, the teeth behind closing up the space thus vacated. This was, of course, just the converse of Mr. Turner's case.

The President said he had met with a case in which a similar state of things resulted in a patient who had been confined to bed for many weeks, suffering from a bad attack of fever; two bicuspids and a molar became raised, and the bite was thus entirely spoilt. He succeeded in restoring it by maintaining pressure on the elongated teeth for six months. The patient was twenty-eight years of age.

Mr. Wm. Holford said he had met with a similar case to that mentioned by the President in a patient aged forty-five; two

molars, second and third, became elongated and spoilt the bite.

Mr. R. White (Norwich) said that in his experience it was not a very uncommon occurrence for the bite to be affected by the eruption of the wisdom teeth. He thought the best plan was to remove these at once.

Mr. Oakley Coles said the adoption of Mr. White's treatment would be attended with some difficulty in Mr. Turner's case, owing to the fact that the third molars were very imperfectly erupted; in the upper jaw one was not through the gum at all.

Mr. Henri Weiss said he had models of a case, which he intended to exhibit at one of the meetings, in which nearly an inch intervened between the upper and lower incisors when the teeth were closed, though the six-year-old molars articulated.

Mr. Cunningham (Cambridge) said that with regard to the treatment of Mr. Turner's case, he should be inclined to extract the upper second molars. He thought that when the jaws were closed the pressure seemed to fall chiefly on these teeth.

Mr. McAdam said he would suggest that the *lower* second molars should be extracted, since the lower wisdom teeth were generally more difficult of eruption than the upper.

Several of the members present expressed their approval of this suggestion.

Dr. Field thought it was impossible to give an opinion as to what should be done in a case of this sort without a careful examination of the patient, more particularly as the models were not articulated. He certainly should not like to give an opinion on the case without seeing the patient.

The President then called upon Dr. Dyce Duckworth to read his paper on "The Characters of the Teeth in Persons of the Arthritic Diathesis."

The Characters of the Teeth in Persons of the Arthritic Diathesis.

By Dyce Duckworth, M.D., F.R.C.P., Assistant Physician to St. Bartholomew's Hospital.

Mr. President and Gentlemen,

I venture, with some diffidence, to lay before you this evening the results of observations that, as a physician, I have made for some years past upon some of the characters of the teeth in persons of the arthritic diathesis.

When I have told you all that I know, you will find that I have but treated of a part of a very large subject, and I can only ask you, of your courtesy, to regard this effort as a small contribution to a study of extreme interest and practical importance, viz., that of the characters of the teeth in relation to the various diathetic habits of the human body.

I must at once declare myself a firm believer in the existence of several well-marked diatheses. It is not much the fashion at the present day to study or allude to these. The tendency of the teaching of the last quarter of a century has been to ignore them, and to trust more to precise

physical methods in examining each individual, in order to elicit the facts of disease and the principles which should guide the treatment of it.

For myself, I had the singular fortune to be trained both in the school of physiognomical and diathetic research, and in that of exact physical diagnosis; and I have always striven to employ both methods to the utmost. I believe that a right interpretation of morbid states and tendencies can only be gained by the conjoint and mutually corrective application of both these methods to the individual.

To those who have not had systematic training in diathetic study the matter is very much like a sealed book, and, without teaching, it will take, even with aptness for the study, well nigh a lifetime for the correct interpretation of the varied forms presented by the several diatheses, either in their pure or commingled conditions.

To study any one of them singly would be a vicious plan, and likely to lead to narrowness of view and untrue generalisations.

Each individual must be referred, as nearly as possible, to his exact diathetic position. This is often difficult, and often impossible. A clear conception of the type of each diathesis must first be gained, and then the measures of departure from this be gauged, and the influence of blended diatheses, or of any cross-taints, be noted. Let me

illustrate this by simply alluding to an instance in which a person of scrofulous habit is cross-tainted with syphilis, or one in which there is a conjoint heredity of both struma and gout. To recognise such commingling there must first be known the types respectively presented by pure scrofula and pure gout, and the special manifestations of syphilitic virus must likewise be appreciated.

A diathesis is recognised by certain characteristics in the bodily conformation. These are special and peculiar in each form, and they are usually inherited, though they may, conceivably, be acquired.

With each conformation there exists also a special tendency and predisposition to disease, or a definite line upon which degenerative changes will most probably take place. Each diathesis has therefore its accompanying cachexia. This was the teaching of Laycock of Edinburgh, my former preceptor, and one of the greatest and most philosophical physiognomists that ever lived.*

Thus, if a diathetic or constitutional condition be recognised in an individual, one may generally rightly predicate the morbid or cachectic tendencies likely to supervene in the life-history of that individual.

The recognition of a diathesis is attained by a

* *Vide* his "Medical Observation and Research," edit. 2, Edinb., 1864; also lectures in "Medical Times and Gazette," January to June, 1862.

study in detail of the several tissues of the body, so far as is possible, and regard must be had to the development of the different systems. The bony conformation and the various portions of the cutaneous system naturally command the greatest attention, and amongst these have to be considered the teeth, which more particularly concern us at present.

It must be borne in mind that for one example which typifies any particular diathesis, we meet with a dozen, or more, in which a blending or commingling with other constitutional or diathetic states occurs. This is exactly what might be expected. An ordinary inheritance is that of commingled diatheses, and it is only when the progenitors on both sides present the characters of one diathesis that we may look for a perfect development of any pure diathesis.

It, however, happens that in an individual the peculiarity of one parent or ancestor is inherited in a more prominent degree, just as in likeness of feature, or in mental character, one member of a family "takes after" one parent or ancestor, while another reproduces the likeness and qualities of the other. For one cannot doubt that these likenesses of feature and character have also as exactly reproduced counterparts in the several bodily tissues, with the same potential qualities as to evolution, and the same tendencies to break down

in similar lines of decay. I assume this as an inevitable law, and daily experience confirms the truth of it.

I have preferred to discuss the characters of the teeth in persons of the arthritic diathesis, rather than to speak about the teeth of the gouty only. I believe it is the case that there is a basic arthritic habit of body, or diathesis, and that from this issue at least two branches, the gouty and the rheumatic stocks. These two are not convertible: they are distinctly different, but they may commingle. One will not produce the other, and will not become evolved into the other.

Both of these branches are very largely prevalent in this country, the gouty one being certainly commoner within the geographical limits of England proper, and most common in the south of England. The rheumatic diathesis is more widely spread and more common than the gouty. London appears to be the headquarters, or centre, of gout, and more true, unequivocal, gouty disease is observed in this metropolis than anywhere else in the world. This is unquestionably true in spite of many pardonable and unpardonable errors of diagnosis. A most interesting question may be asked, and one to which no answer can be given, as to the time when the peculiarities now recognised as associated with the several diatheses, first manifested themselves. We have in this

country, I suppose, as mixed a race as can be found anywhere in the world, and the comminglings of every known habit of body have been going on amongst us for centuries. Such varied blendings, however, give small indications, except in cases where there is sufficient predominance of characters which may be referred to any one diathesis, or to compounds of it and some other. Hence, it is very important not to be too dogmatic in asserting of any one class that such and such characteristics *always* prevail. We must take note of the indications in each instance, and, from study of a large number of examples, we may gather knowledge as to the type common to the majority. It is in this manner that I have sought to supply to-night such information as I can give respecting the dentition in persons arthritically predisposed and affected.

Already, this session, a communication has been read to this Society by Dr. Alfred Carpenter, in which some very dogmatic statements were made as to the teeth in persons the subjects of gout. These opinions were challenged by several speakers in a subsequent debate upon the subject, and I also propose to discuss them as I proceed.

I regret that I have no sufficient number of facts to guide me to an opinion respecting the primary dentition of those inheriting gouty or rheumatic tendency. Such knowledge as I have

warrants me in affirming that the evolution and development of the milk teeth in such children is, for the most part, very satisfactory, and in strong contrast with that observed in the children of strumous parentage.

Let it be noted, at once, that the inheritors of an arthritic constitution are in no way free from a possible strumous or syphilitic taint, and that they, equally with other children, may be the subjects of ill-development owing to rickets or other devitalizing causes.

But, given a fair chance in the world, the fact remains, I believe, that primary dentition in such cases is eminently satisfactory, and about as good as can be desired.

Without reference to either primary or secondary dentition, Dr. Alfred Carpenter stated that "the effects of the gouty diathesis do not show themselves so markedly upon the teeth in early life as is the case with the syphilitic or the tubercular states." To this I agree.*

Dr. Carpenter proceeded further to state that "he believed the teeth decayed sooner in those who were descended from gouty parents; that they were more prone to caries, and especially liable to those peridental inflammations which ultimately lead to necrosis."

* "Brit. Med. Journ.," November 18, 1882, p. 984.

To these statements I cannot at all agree. My experience supplies very different evidence.

I have paid particular attention to the condition of the teeth in at least 300 hospital patients, *who were the subjects of unequivocal gout in every degree.** Amongst these were cases in which the disease was inherited in very varying degree, and in which it seemed to have been newly acquired. These observations, noted at the time in my books, formed part of a systematic study of the textural physiognomy of the gouty, and were made with no other object than to record exact facts relating to this matter.† The main results of this inquiry might be summarised in a few words, and are to this effect, that the teeth of the gouty are remarkably strong, well-enamelled, enduring, and unusually free from decay.‡

Laycock taught this five and twenty years ago, and the same facts, I am informed, were also demonstrated by his pupil, Mr. Jonathan Hutchinson. My friend and colleague, Mr. Coleman, tells me his experience fully confirms these statements.

So much then for the main features of the teeth

* It is, of course, not possible to study the teeth of one's private patients as is done in a clinic; but my observation, so far as I have conducted it, in this sphere, fully confirms all the statements and opinions put forward in this paper.

† "I am indebted to my clinical clerk, Mr. Chapple, for a careful analysis of my hospital cases illustrating this point.

‡ "Gouty people generally are not more than others liable to decay of teeth and the consequent pain."—"Clinical Lectures and Essays," Sir James Paget, edit. 2, p. 372, 1879.

of the gouty. Much more remains to be said. I find that the teeth are commonly large and regular.* The edges are smooth in the permanent set, not crenated in cases of pure arthritic constitution. It has been noted that there is a tendency for one or more of the incisor teeth in the lower jaw to be pushed forward in persons of the arthritic diathesis. To this irregularity Laycock gave the name of "buck teeth." I have frequently found this to be the case, but I am not prepared to affirm that such a condition is always significant of this particular habit of body, and I believe that it is not confined to such instances. Overcrowding is less common by far, in all cases, in the lower jaw than in the upper, and so there seems less reason for this ejection from the ranks in cases where, as in persons of good gouty constitution, there is no imperfect development of the inferior maxilla. These "buck" teeth may not be produced till middle life, and thus, incisors that have once been well in rank come to be partly turned round, or pushed forward. I wish I could furnish an explanation of this occurrence. I can only call attention to a well-observed fact, and one, perhaps, not sufficiently recognised. Laycock was of opinion that this occurrence was more common in persons who presented signs of the

* I have sometimes observed that the teeth are small in size, though well-formed, regular, and strong, with yellow tint of enamel.

asthenic arthritic diathesis. I think, however, that I have certainly observed it in cases of the sthenic form.

Overcrowding may occur with, perhaps, as much frequency as in other habits of body, much depending upon the maxillary development. It has been observed that the children of gouty inheritance are apt to grind their teeth during sleep, and this habit may go on into adult life or mature years. So vigorous may this be that I have known the enamel, which is so strong in such persons, to be chipped and broken off by it. In colour the enamel is most commonly yellow, and white teeth are somewhat exceptional. The colour is apt to deepen a good deal in middle life. In texture it is very hard. The teeth are in every way vigorous and firmly planted, and if extraction has to be practised the operation is as formidable in these cases as it ever can be.

There is a remarkable tendency for the teeth to be worn down on their free surfaces, sometimes showing the pulp cavity. This is quite in strong contrast with what is met with in the teeth of persons not arthritically disposed. It is often supposed to be due to habits of pipe-smoking, but this is plainly not always the cause of it, and it is almost as commonly seen in women as in men. It is certainly not always due to grinding in sleep.

There is also a great proneness for tartar to

collect upon the teeth. Dr. Copland noted long ago that such incrustation indicated a tendency to gouty affection.* If the teeth are not regularly and properly cleansed this accumulation may reach extraordinary proportions, and, even with due care, collections will form along the inner gingival edges of the lower incisors. I am not aware that there is any peculiar chemical difference in the tartar of the gouty person as compared with that met with in others, and I feel indisposed to assent to Dr. Alfred Carpenter's statement that "lithate of soda is deposited in the circumdental membrane, and produces those diseases of the teeth to which the gouty classes are especially liable." I dispute the fact that these classes are especially prone to dental diseases, and I know of no careful observations which have proved that lithic acid is deposited in the periosteum of the teeth. I have not been able to find any chemical reactions in the tartar from gouty teeth indicating the presence of lithic acid.

I have observed, in a good many instances, that *perfectly sound teeth* are apt to be shed in persons who inherit gouty constitution.

This is a very remarkable fact. A process of alveolar absorption appears to induce this loosening, though how this absorption comes about I am unable to tell. The last instance in which I noted

* "Dictionary of Medicine," vol. iii, p. 984.

this occurrence was in a young man aged twenty-six. A sound lower incisor tooth had been cast off, and the gum was absorbed along with the associated alveolar process. The gums were generally retracted, but the teeth were strong, yellow, and well-enamelled. This man inherited gout, and had his first attack at the age of twenty-six. Amongst my gouty cases I find notes of several persons who have become prematurely edentulous, and of many who have lost several sound teeth, or suffered loss in this way, and also by complete decay.*

With respect to cases showing caries, and also much tartar accumulation, I find that the majority have been careless persons, and more or less intemperate, and the significance of this fact for me is, that such habits distinctly lead both to worse gout, and to much of the dental caries. Temperate gouty persons—and there are large numbers of such people, in spite of common and prejudiced views to the contrary—have good, strong, and sound teeth as a rule. If they abuse their con-

* In a discussion which was held in the Dental Section of the International Medical Congress in 1881, upon the causes which led to alveolar absorption and loosening of teeth, I notice that no allusion was made to the frequency of this affection in persons of gouty habit of body. I find amongst my cases one of a healthy old woman, æt. eighty-two, who inherited gout from her father and paternal grandfather. She first became gouty herself at the age of seventy, and has now deposits of urate of soda. Between her sixtieth and seventieth year she lost many of her teeth, which were quite sound, and gradually became loose. She is now quite edentulous.

stitutions by intemperance, they rapidly induce gouty cachexia. This is a very different matter from a gouty inheritance or predisposition, in which, with care, no overt or serious gouty trouble need necessarily supervene.

It is therefore an error to place all cases of gout in one category, and to affirm that in such instances one may naturally expect to find carious teeth and many other dental troubles.

There remains to be said something respecting tendency to decay in teeth in persons of the arthritic diathesis. Amongst these are to be noted many instances in which florid complexion, with dilated small vessels, together with other signs in the circulatory system, betoken the existence of the vascular or sanguine form. The corresponding cachexia is shown by a tendency to atheroma and degeneration of the blood-vessels. This, again, leads to further tissue-degeneration, and hence the teeth are prone to suffer from imperfect blood-supply, and thus to decay in such cases. It is in this way, I conceive, that a good deal of the alveolar absorption, loosening, and caries of teeth met with in these persons is to be explained. The trouble arises from a defect in nutrition, due to the outcome of vascular changes. These changes are not due to the arthritic proclivity, as such, but attach themselves only to certain members of the great arthritic

family, to wit, those of the vascular or sanguine variety.

I cannot doubt that erroneous opinions respecting the teeth of persons who are gouty, or are rheumatic, in varying degree, have been formed because the fact of commingled diatheses has been unrecognised or ignored. An inheritance of scrofulous taint, together with arthritic disposition, will materially affect the development and life-history of every dental tissue, and the characters proper to each will prevail according to the degree of heredity of each. Strumous taint appears to affect the enamel very materially, and there is special tendency to decay, the teeth being irregular, ill-developed, more or less serrated at the edges, and dingy in colour.

Inherited syphilitic taint will likewise modify the growth and form of the teeth of the arthritic, in the well-known manner described by Hutchinson, though the evils wrought here, *cæteris paribus*, are mischievous in less degree than in the case of strumous diathesis similarly cross-tainted.

The characters of the teeth in persons of rheumatic habit of body are certainly less remarkable than those which are noted in the gouty. The several tissues of the body appear to be less impressed by the conditions which lead up to rheumatic tendency than is the case in gout. Yet, for the most part, there is much similarity,

and I recognise amongst the features of rheumatic inheritance the presence of strong, hardy, and well-enamelled teeth as the rule. This is not remarkable if it be true that both gouty and rheumatic predispositions are referable to the great arthritic (basic) family. In each case, however, the intervention and modifying influences of cross-taint and mingled diatheses must be considered.

Of the functional troubles of the teeth suffered by the arthritic but little need be said.

Sir James Paget has well described the painful state experienced by gouty persons in which the teeth feel as if loosened, and raised from their sockets, and are very tender when brought in contact—as if, he remarks, the alveolar periosteum was swollen.* This condition seldom lasts more than a day or two, and subsides without any marked effects. It may come on very suddenly, as is the habit with many gouty affections, and may generally be traced to cold or to some alimentary disturbance.

I think that I have observed a greater tendency in persons of this diathesis to suffer from radiating neuralgia, affecting many teeth in both upper and lower jaws, as the sequel to that form of severe nasal catarrh which is properly called *gravedo*, in which the cavities of the antra, the frontal,

* *Op. cit.*, p. 372

ethmoidal, and sphenoidal sinuses are involved. Teeth that have been stopped will commonly ache more than sound ones under these circumstances, but the pain is sometimes worst in the strongest and soundest teeth.

Retraction of the gums in an extreme degree seems to be generally associated with some measure of alveolar absorption, and much tartar is seen oftentimes on the exposed necks of the teeth. Amongst the poor such a state is seen in persons both of arthritic and of other dispositions. It is generally significant of gross neglect of the teeth; but these conditions of alveolar catarrh, osteo-periostitis, and loosening are also symptomatic of diabetic cachexia, and should lead to special investigation of the urine if other more obvious signs of the disease have not already been recognised.

It would be a matter of much interest to inquire into the condition of the teeth in countries where gouty disease is unknown. The best American authorities declare that they hardly ever see unequivocal gout, even in the practice of large cities. All the factors leading to its occurrence have not hitherto been present. They may come, and conspire to introduce it to generations yet to be born.

Civilisation is not credited by dental surgeons with having brought blessings along with it for the development and life-history of the teeth—

rather the reverse, indeed; but the progress of their science has done much to repair the ills incident to exposure to luxury. It is a great matter that the dental textures are studied in relation to their whole anatomy and physiology, and it will be an additional advance when the great doctrines of diathetic predisposition, and of scientific physiognomy, are carefully worked out and applied to practice. I venture to hope that in this brief communication I may have contributed something towards such a study, and may enlist the interest of dental surgeons in the subject.

Discussion.

The President said that he had recently looked carefully through the records of his practice,—and he noted brief particulars in a tabulated form of every case which came under his notice,—and the result of his investigations fully confirmed Dr. Duckworth's statement as to the comparative freedom of gouty individuals from dental caries. He could instance four families in which the gouty tendency was very marked, and in which the teeth of the children, of whom there were four or five in each family, were exceptionally good. In three of these the children, aged from twenty-four years downwards, were absolutely free from caries, and there could be no doubt of the fact that, generally speaking, those inheriting a gouty tendency were much less liable to caries than other people.

Mr. Coleman said he had listened to Dr. Duckworth's paper with great interest, and he considered that the Society was greatly indebted to the author. He (Mr. Coleman) could thoroughly agree with almost everything in it. As regards Dr. Duckworth's description of the colour and general character of the teeth of gouty patients, he could quite support all that had been said. Dr. Duckworth appeared, however, to have some doubts as to the specific character of gouty periostitis; as to this, he could only say that he had suffered from it in his own person, and had always found that it was at once relieved by the same remedies which relieved other gouty manifestations, and he had met with the same success in treating others. So that, whether or no there was any truth in Dr. Alfred Carpenter's supposition that the inflammation was due to a local deposit of lithate of soda, there could

be no doubt that it was in some way intimately connected with the gouty state.

He quite agreed also with Dr. Duckworth's observations with reference to the liability of gouty people to the deposit of tartar. Seeing that gout and rheumatism were generally supposed to be due to the presence of an excess of acid in the system, one would have rather expected that such people would have been less liable to deposits of tartar than others; but, as a fact, he had found that the saliva of such patients was generally unusually alkaline. This was, however, quite in agreement with what was generally found, viz., that if some of the secretions had an excess of acid, others would have a deficiency. Thus, the saliva was alkaline during digestion, whilst the secretions of the stomach were strongly acid.

Dr. Duckworth had called attention to the absorption of the alveoli and loosening of the teeth to which gouty people were liable, but he added, "how this absorption comes about I am unable to say." He (Mr. Coleman) believed it was intimately connected with the state of chronic congestion of the alveolo-dental membrane, which was so constantly seen in these cases. It was found that a state of chronic periostitis, from whatever cause induced, was always attended by a process of alternate absorption and deposition of bony matter in the socket; these opposite processes took place very irregularly, and their result was the loosening and ultimate loss of the teeth.

Mr. Gaddes showed models, which had been sent him by Mr. Joseph Holland, of Sloane Street, of the mouth of a boy, thirteen years of age, who was the subject of inherited gout, of which he had already had two or three attacks. The boy's father also had gout whilst he was a boy at school, suffered from it constantly through life, and eventually died of it. His uncle had suffered in the same way, and was now crippled by the disease. The father of these men, the boy's grandfather, also died of gout. Of the present generation this boy was the only one who had good teeth, but the enamel of the first molars, second bicuspids, and cutting edges of the incisors

presented a peculiar crenated, bunodont appearance. His sisters had the six-year-old molars decayed, and the rest of the teeth badly enamelled. He (Mr. Gaddes) wished to ask Dr. Duckworth if the peculiar appearance of the enamel in this case was in any way connected with the gouty diathesis.

Mr. Storer Bennett remarked that Dr. Duckworth had not alluded in his paper to the erosition of the necks of the teeth which was so commonly seen in gouty patients. Dr. Duckworth had alluded to the deposit of tartar in the mouths of gouty persons, and to their liability to absorption of the alveoli; but he did not appear to have noticed the connection between the two. In his (Mr. Bennett's) opinion, they were related together as cause and effect. Small nodules of very hard tartar were deposited round the margin of the alveolus; these irritated the gum and alveolus, and absorption followed.

Mr. S. J. Hutchinson said he should be glad if Dr. Duckworth could tell him what was about the average age of the three hundred cases of gout referred to in his paper. He thought the most general opinion was that gout was most commonly met with in elderly people, and that it was generally due to excesses of some kind. A large proportion of those who indulged in excess of eating or drinking were carried off by various diseases, whilst those who stood the process of "seasoning," and lived to become gouty, were people of exceptionally strong physique; and it occurred to him that the reason why their teeth were good might rather be due to this fact, than to their being gouty.

He wished also to ask Dr. Duckworth if he had noticed the peculiar shape of the teeth of gouty patients—the cutting edge being broad and straight, the surface smooth and not indented, whilst the neck was narrow and constricted? He had been rather surprised that Dr. Duckworth had not noticed this peculiarity in his paper, as he (Mr. Hutchinson) had come to consider it a very characteristic feature of this class of patients, and he would be glad to be confirmed in his opinion by Dr. Duckworth's experience.

Mr. Henry Moon said there could be no doubt that Mr. Hutchinson was quite correct in saying that this peculiar shape was very characteristic of gouty patients, but he doubted whether the peculiarity was not more apparent than real, whether it was not due to the fact that, owing to retraction of the gum, more of the neck of the tooth was seen in these cases than in others?

Mr. Hutchinson said he did not think it could always be explained in this way. At the depôts the shape he had described was called the "natural" shape!

Mr. Stocken said he could quite corroborate what Mr. Hutchinson had said on this point.

Mr. McAdam said he had lately had under his care a very peculiar case of suppuration of the mucous membrane covering the gums in a patient of sanguine arthritic diathesis. It began with acute swelling of the mucous membrane, but the teeth were not at all tender. Was this at all connected with the patient's gouty tendency?

Mr. Ashley Gibbings said he should be very glad to hear some explanation of the very characteristic wearing down of the teeth which was seen in gouty patients. It was certainly very remarkable that strong teeth, well coated with hard enamel, as these generally were, should wear down in this way.

Dr. Duckworth having been called upon to reply, said he had to thank the members for the way in which they had received his paper. He had not himself paid any special attention to the character of the saliva in gouty patients, and the chief fact bearing on this part of the subject with which he was acquainted was the observation of Dr. Fenwick that the saliva of gouty people contained an evident excess of sulpho-cyanide of potassium. This was easily demonstrated by adding a little perchloride of iron, when a blue colour would be produced. With regard to the case spoken of by Mr. Gaddes, he doubted whether it was a case of pure arthritic diathesis; he thought the influence of some cross taint, possibly strumous, was indicated. In reply to Mr.

Hutchinson he would say that the age of his patients varied from twenty-five to sixty-five years of age, and no doubt most of them were persons of middle age. Still, as he had pointed out in his paper, he had referred chiefly to cases of *inherited*, rather than to *acquired*, gout; and a good many people suffered from gout who were not guilty of excesses, though their ancestors might not have been equally blameless. Still there was no doubt some truth in Mr. Hutchinson's suggestion, and that the principle of "the survival of the fittest" was not without its effect in this as in other cases. He quite agreed with what Mr. Hutchinson had said about the characteristic shape of the teeth in gouty subjects, and was sorry he had omitted to mention it in his paper. He had not met with any cases of superficial periosteal swelling due to acute gouty inflammation, such as that described by Mr. McAdam. Nor could he explain the cause of the wearing down of the teeth of gouty people—in fact, he had asked for information on this point in his paper, and hoped to have learnt something about it from the Society.

On the motion of the President a hearty vote of thanks was passed to Dr. Duckworth for his interesting paper, and also to the readers of Casual Communications.

The PRESIDENT then announced that at the meeting on June 4th the discussion on the Theory of Caries, begun by Mr. Sewill at the February meeting, would be resumed and concluded.

(The meeting was then adjourned.)

CORRIGENDA.

In March number of Transactions, page 151, 13th line from top, *for* "medical improvement," *read* radical improvement; page 152, 9th line from top, *for* "chemistry food," *read* chemical food.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

June 4th, 1883.

DR. JOSEPH WALKER, PRESIDENT, IN THE CHAIR.

The Minutes of the previous meeting having been read and confirmed,

MR. HARRISS NEWTON signed the Obligation Book, and was formally admitted to Membership by the President.

The PRESIDENT announced that MR. HUGH PATERSON, of 229, Macquarie Street, Sydney, New South Wales, had been duly nominated as a candidate for Membership, and would be balloted for at a subsequent meeting.

MESSRS. RICHARD HARRISON, L.D.S.Eng., 213, Camden Road, N.; and
ARTHUR ALEXANDER MATTHEWS, L.D.S.Eng., of North Parade, Bradford, were balloted for and elected Members of the Society.

MR. S. J. HUTCHINSON showed a model which had been sent as a donation to the Museum by Mr. George Holt, L.D.S.I., of Bury. It was the model of the upper jaw of a boy, ten years of age, showing four conical incisors and two small molars. The former were erupted when the boy was between three and four years of age; the eruption of the molars was not noticed. He had no teeth whatever in the lower jaw. The boy was delicate, with nearly white hair, of very fine silky texture, but had no other peculiarity. There were three or four other children in the family, and their teeth

were all natural. The mother stated that during nearly the whole time of this pregnancy she suffered greatly from sickness, vomiting after almost every meal.

He also showed a model sent by Mr. Richards, of Hastings, showing two supernumerary teeth situated between the upper centrals. Mr. King, of Ipswich, had also sent a geminated central incisor.

Mr. Stocken showed a model of the upper jaw of a child, five years of age, who had only two abnormal teeth in the front of the mouth, the lower jaw being quite edentulous. The child was very intelligent, but had always a dry skin. He had an attack of pneumonia when only a few days old; when nearly two years old he had a fit, and another at two years and eleven months; otherwise he had had good health. The two teeth were erupted at about two years of age. His mother said she suffered from constant sickness during the pregnancy.

Mr. Coleman said the teeth appeared to him to be permanent incisors, and he thought it probable that there had been temporary predecessors which had been overlooked. He had met with similar cases himself, and he thought their not very infrequent occurrence was interesting in connection with the opinion which had been put forward that we were gradually becoming an edentulous race.

Mr. Stocken said he had made particular inquiries with reference to the existence of any temporary teeth, and had been assured by the mother that the child had never had any other teeth than these.

Mr. Coleman showed an upper molar, extracted by Mr. Read, of Finsbury Square; a small portion of the floor of the antrum had come away with the tooth.

Mr. Walter Coffin showed a Pressure Escape Quieter for Nitrous Oxide Gas Cylinders, and explained its mode of action. The use of liquid nitrous oxide gas, administered by bag direct from the bottle, was attended with a good deal of inconvenience from noise and liability to freezing. Even if the valve be carefully opened, and the bag slowly filled, the rushing or

hissing sound was objectionable; but when, either to supply rapid and deep respiration, to overcome a temporary obstruction, or by accident, the valve was opened a little more, the noise might become sufficiently formidable to alarm a nervous patient, and to distract the attention which the operator should be giving to the effects of the anæsthetic. Moreover, the sudden liberation of the great pressure permits of a sufficiently rapid expansion of a part of the liquid gas to lower the temperature of another part of it below its congealing point, causing a stoppage at the valve, or just beyond, and intermittent, or spluttering, escape. This was not only unpleasant, but might even give rise to slight explosions, sometimes rupturing the indiarubber tube or bag. For these reasons, where portability was not essential, a more capacious and bulky gas-holder, filled from the bottle, was often substituted for the bag, but he was not aware of any practical means having been suggested for avoiding these objections while retaining all the simplicity and portability of the bottle-and-bag arrangement.

Fortunately, the problem of silencing the escape of steam, or gasses at high pressure, had been attacked and solved by an American engineer, Mr. P. J. Justice, of Philadelphia. He found, after much experimenting, that an escape into a closed chamber, with an enlarged area and opening, completely filled with small round bodies, such as marbles or beads, was perfectly noiseless, and further, that if the chamber was sufficiently large, no back pressure, or diminution in the discharge or flow, was produced.

Mr. Coffin induced Mr. Justice to try a small model of one of his "quieting chambers" upon a nitrous oxide gas-bottle, and he also kindly assisted Mr. Coffin in determining the best modification of it for checking and regulating the flow and pressure of the gas. It was found that this could be done by reducing, to a certain extent, the diameter or area of the chamber, increasing its length, and diminishing the size of the little spheres or beads. The small appliance he now showed was the form ultimately arrived at. It consisted of a metal tube—his was of brass—about an inch in diameter inside, and 10 inches long; it was filled with very small glass or porcelain

beads about $\frac{1}{16}$ inch in diameter, and closed at each end with a wire gauze diaphragm. It was connected at one end by screw union with the bottle, while to the other was attached the tube leading to the bag. It would lie alongside the bottle in the portable box or case so generally used, and could be attached to it in any position for the floor or table stands. The expansion of the gas taking place gradually along the whole length of the tube allowed time and surface for a sufficiently rapid interchange of temperature to prevent any stoppage under ordinary circumstances, though the free and continuous discharge of the whole of a large bottle might sometimes occasion solidification. But it was perfectly easy, with the help of this quieter, to administer without any embarrassment large quantities of gas direct from the bottle with rapidity and in perfect silence. Mr. Coffin then demonstrated the truth of his statement, showing that with the "quieter" attached, the escaping gas made no sound even when the valve was widely opened, whilst the gas escaped freely and uniformly with greater rapidity than could ever be wanted in practice.

Adjourned Discussion on the Theory of Caries.

The President then re-opened the discussion on the Theory of Caries, adjourned from the February meeting.

He said he had received letters from several members and others, who took an interest in the subject, regretting their inability to attend the meeting that evening. He had made some inquiries with reference to the prevalence of caries in the teeth of animals, thinking that possibly by this means some light might be thrown upon the cause of its prevalence in man, and would read two letters he had received relating to this aspect of the question. One was from Mr. Robertson, Principal of the Royal Veterinary College, Camden Town. He said, "I am satisfied that, during the last ten years, diseases of the teeth of the horse, chiefly caries, have been much more generally recognised than formerly. Whether because skilled attendants have been now employed, or because disease of these structures has been more frequent, may be difficult to tell. This accession of dental disease applies particularly to rural districts, where the probabilities are that river water is largely used for drinking purposes." Mr. Thos. Walley, of the Edinburgh Veterinary College, replied as follows:—"In reference to your query as to the prevalence of caries in the teeth of horses, I may say that it is not at all common, nor has it been so during the last ten years, in this part of Scotland. I am told, however, that in the North it occurs with comparative frequency. As all animals here are supplied with water from the common reservoir, I cannot say anything about the influence of hard or soft water in its production."

With regard to his own opinions on the subject under discussion, he thought that Mr. Sewill deserved the thanks of the Society for the way in which he had brought forward

facts which had been established by Messrs. C. Tomes, A. Underwood, and Milles in this country, and by many distinguished investigators on the continent of Europe, and in America; but at the same time he thought that Mr. Sewill had scarcely given sufficient prominence to certain other facts which, in his (the President's) opinion, appeared to be quite as well worth consideration. All would admit that caries was, to some extent, an effect of external causes, that it was due to the solvent action of acids generated by fermentation going on in the mouth, and that bacteria and micrococci played a most important part in accelerating the rapidity of caries, if not actually an active agent in its production. Messrs. Charles Tomes and Milles had kindly undertaken to speak that evening, and they would explain their views on this point. But if the acidity of fermentation was the only cause of caries, how could the fact be explained that dental surgeons were daily seeing caries arrested;—a black polished surface on one tooth, whilst its neighbour was fast crumbling away? "There can be no question," said Mr. Charles Tomes, in his well-known work, "that the tendency to caries, whether induced by structural deficiencies or perverted functions, is strongly inherited. This inherited predisposition, so strongly marked in families, extends to whole races, and is probably due to defective development." Whilst Dr. Hitchcock states, with reference to immigrants into the United States, that the typical characteristics of races are usually effaced after the lapse of two generations, the descendants possessing all the peculiarities of, and their teeth being apparently as liable to caries as the teeth of native Americans. This, again, would point to defective development as being the cause of caries, and probably, also, to some endemic cause for this defective development.

It had been shown by Coleman in 1862, by Rottenstein in 1868, and by Charles Tomes in his work, published in 1873, that the various acids act on the dental tissues each in a manner peculiar to itself, but none of them decomposes either of the dental tissues in a similar manner to caries. Moreover, the presence of these acids in the oral cavity was

nothing new. Hence to account for the existing frequency of dental caries we must again fall back upon defective development. This might be due to a deficiency of mineral salts in the food, either from the quality of the water supply, or from deficiency of fresh vegetables, or the removal of the husk from cereal food; or it might arise from undue excitement and irritation of the nerve centres during the development of the dental tissues. Some information as to the relative importance of the water supply, errors in diet, or the influence through the nerve centres of the excitement of the present age in the production of caries, might be obtained by a careful study of the occurrence of the disease in domestic animals. There could be no doubt, also, that congestion of the mucous membrane favoured the occurrence of caries, and that successful treatment of this condition would greatly diminish its frequency.

Mr. W. J. Milles: As Mr. Arthur Underwood is unable to be present to-night, he has asked me to make any remarks I choose in his place. I shall confine my observations more particularly to the subject which we have been studying together, viz., the action of micro-organisms in the production of dental caries. We have found that micro-organisms are always present in all cases of caries in certain definite lines—the lines they take up are along the course of the dentinal tubes. In the most superficial part of caries the tubes are broken up and crammed with organisms,—micrococci, bacteria, both oval and rod-shaped, and some fungi, such as the leptothrix,—the leptothrix being more in the superficial part, and never penetrating deeply into the tissues. In the deeper parts the organisms become less numerous; they follow distinctly the line of the tubes, branching out here and there, and in the most internal parts they are frequently diminished down to single file. These observations have been corroborated in various ways. I may mention that Dr. Miller, of Berlin, has substantiated them in nearly every point, though he makes some slight differences. He considers that the leptothrix which is found in the more superficial parts becomes in the deeper parts converted by

gradations into long bacteria, then into small rods, then into the oval bacteria, and lastly into the micrococci. Our observations are distinctly opposed to this view, for we have invariably found that along any isolated tubule you may take, the same kind of organism is always present. If at the superficial part it is a rod-shaped bacterium, then up to the very terminal part of the tubule it is still a rod-shaped bacterium. So an adjoining tubule may contain micrococci, but the micrococci pass along the whole of the tubule, and we find no other kind of organism in the single tubule. This shows very nicely a natural experiment which can be produced artificially. You probably all know that the flask experiments, made in the first instance by Pasteur, and improved by Koch, act in a somewhat similar manner. If you take a long tube and fill it with some purified materials, such as gelatinous meat infusion, absolutely pure, heat it up to a certain temperature, so that no organisms can be present, and then inoculate the surface of it with a special organism, that will grow from the surface of the tube down to the bottom, and you will find nothing else present but the special organism. So in the mouth it seems that each tubule is apparently naturally inoculated by a special organism, and this leads to the presence of others, and thus you have these special organisms in the isolated tubules. The view that Dr. Miller takes, as to the change from leptothrix into bacteria, and finally into micrococci, is certainly opposed to all modern ideas of the life-history of micro-organisms, for it is known that each kind always produces its like. Dr. Miller, though he agrees with us in the main facts of the microscopical appearances, yet draws some rather different conclusions. He considers that the micrococci and bacteria have no great effect in the active production of caries in the earlier stages—in the stage of decalcification,—he considers rather that caries is produced by fermentative processes going on in the mouth. But after all that comes to the same view as we hold. Fermentation, as every one knows, is really produced by the presence of micro-organisms and fungi; fermentation in the mouth is produced by the same

causes which produce it elsewhere, and therefore it comes to the same thing, that these micro-organisms are really, as in our view, the chief factors in the production of caries. They produce fermentation and putrefaction, an acid is formed, and so you get decalcification and breaking down of the dentinal structures.

This view of the active participation of the micro-organisms in the production of caries is strengthened by a consideration of the opinions now held in reference to them in general medical literature. Every year observations are being made showing that different forms of micro-organisms are really active factors in the production of disease. I need scarcely mention the bacillus of tubercle, which everybody knows now-a-days is really considered by most scientific men to be the active cause of acute tuberculosis and tubercular phthisis. So, again, with regard to infective diseases, we are gradually coming to the view that their active cause is some organism. Lupus, leprosy, septicæmia, erysipelas, gonorrhœa, and syphilis may be placed in this class. Again, certain diseases in the lower animals, such as anthrax, cholera of chicken, &c., have been demonstrated by exact experimental observations to be caused by a special micro-organism. This may afford some little additional proof in favour of the fact that micro-organisms are really the active producers of caries.

One of the most important points, I think, in considering the pathology of caries, is the production of artificial caries. I am not quite certain of the point, but I believe at present it is rather a moot point as to whether artificial caries really can be produced—that is, whether identically the same pathological changes are found in a tooth in which artificial caries is produced out of the mouth as are found in the mouth itself. Mr. Underwood's observations and my own, as far as they have gone at present, tend to show that one cannot produce artificial caries exactly similar in every respect to that in the mouth. We have made a number of experiments, under conditions as similar as possible to those in the mouth—conditions of equable temperature, a certain pabulum to the tooth, alterations of the fluid, changing it several times a day, &c.,—but

we have been unable to produce exactly the same microscopical appearances as one finds in caries in the mouth. There is, undoubtedly, softening of the tooth; but one has to distinguish decalcification from caries. You get decalcification from the fact that fermentation, it may be of a different kind, produces an acid which decalcifies the teeth; but you do not find the same arrangement of the micro-organisms in the tooth thus artificially treated as you do in the natural disease. I have limited my observations more to the pathology of caries, and not to the conditions which the President mentioned just now as to its primary causes with regard to the deficiency of lime-salts, weakness of the enamel, &c. I have preferred to speak of the conditions which we have observed ourselves. I may mention that in speaking of changes which occur in teeth in the mouth, I include those which occur in the ivory dentures that are used I believe in dentistry, or that have been used; the change in the ivory is the same as in caries of natural teeth, and the explanation of this seems to be that the denture is subjected to exactly similar conditions in the mouth as the natural tooth is. In the attempts at artificial production of caries it is impossible to produce conditions exactly similar to those which occur in the mouth. You cannot get the fluids secreted at the moment, and covering the whole tooth. It may be that these organisms require certain special conditions to produce their changes. We all know that special organisms have special attributes. It is with the greatest difficulty that the bacillus of tubercle has been made to grow externally to the body. It has to have a certain equable temperature, and will only grow on a certain soil, the soil being solidified blood serum. It will not grow under other conditions external to the body. So it seems to us with regard to artificial caries. It is not the same as the caries which occurs in the mouth, because it is impossible to produce exactly the same conditions as go on in the mouth. And, therefore, the fact that caries cannot be made to go on in teeth which have been removed from the mouth, is not opposed to the view that the micrococci and bacteria are really the active causes in the production of caries.

Mr. C. Tomes: There are very few things that I should like to say in taking part in this discussion on dental caries, because I have, unfortunately, not had the time to make any observations upon the subject recently, and because this discussion arose, I think indirectly, as a kind of protest against the subject being befogged by a great number of generalisations based, not upon scientific facts capable of being recorded, and capable of being accurately described, but based upon general impressions. It seems to me that any person who contributes to the literature of any subject his general impressions, and does not put down any recorded facts from which other persons can form their own impressions, has not only contributed nothing of value to the subject, but he has committed a species of literary or scientific crime, because he has given other people the trouble of wading through a quantity of material, and when they have done that they will find that they will be not only none the wiser, but will probably be somewhat befogged. As I have not, therefore, any observations of my own to bring before you—at all events, no recent observations—no observations that are not recorded elsewhere,—I have very few words to say. The prominent aspect of the question which is before us is the one that is before the whole medical profession, of which Mr. Milles has just been giving us an account, namely, what is known as to the influence of micro-organisms on the production of dental caries. So far as my own slight investigation into the subject has gone I am inclined to go fully with Mr. Underwood and Mr. Milles in what they have described, and in what they believe, only I think there is always this danger. We know certainly, quite clearly, that micro-organisms do accompany caries; we know certain things about the way they accompany it; we know how they run down the tubes; and we know pretty clearly and distinctly, as Mr. Milles has mentioned to-night, that there are certain definite micro-organisms which are capable of cultivation, and which are capable of breeding true, and that they do not run into one another as Dr. Miller has implied or asserted in his paper. But I think, while we recognise that fully, we must not forget that there are a number of other influences

which must come together. We must have a coincidence of a number of conditions before caries is produced, whether it is produced by the agency of the micro-organisms or not. There is an instructive comment on that in some of Dr. Miller's experiments, in which he attempted to inoculate portions of sound dentine with micro-organisms from portions of unsound dentine. His experiment failed, as one would have expected it to fail, because all the conditions which one would expect to be requisite for success were not there. The experiments are, notwithstanding, very valuable, because they do show that the micro-organism is capable of growing under certain circumstances which do not enable it to attack dentine —that is to say, he found a certain multiplication of his micro-organisms upon dentine, and he did not find any softening of that dentine which could be detected. Therefore he seems to me to have contributed one valuable fact to our knowledge of the subject, namely, that it is possible for the micro-organisms to be growing, and yet for the whole set of conditions necessary to produce caries not to be there. I think we may get some clue possibly to the reason of this if we look into the experiment that is sometimes performed for us by acute disease. I have within my own knowledge seen several cases in which patients, having rather exceptionally sound teeth up to the age of full adult life, twenty-five or thirty, have suffered from a severe attack of typhoid fever, and then their teeth have gone with the most extraordinary rapidity all round the necks, and all in between—everywhere that they could. Now it seems to me that it is not particularly likely that those mouths had escaped infection with micro-organisms up to that date, but simply that the disordered oral secretions that were left behind by the typhoid fever—the condition of the gums and so forth, as visible to the naked eye—had afforded to the micro-organisms the pabulum needed not only for their own growth, but for the development of those acids which decalcify dentine and which go so far towards producing caries. It seems to me that the only reason why all teeth are not always destroyed,—because all teeth must be continually exposed to micro-organisms, and a single carious

tooth in your head must supply spores enough to destroy every tooth in your head and in those of all your friends—but that does not happen; and it seems to me that the only reason why it does not happen is that there is needed the coincidence of other conditions, and that those conditions are most often to be found in the oral secretions of the individual. I could say a great deal more about my own belief and my own impressions upon the subject, but that is exactly what I do not wish to do, and what I do not wish anybody else to do. I have seen these few cases of typhoid fever producing an abrupt and most marked change in a mouth. Those are the only experiences which I have to bring before you. About those I have considered myself justified in saying a few words, and I hope I have not stultified myself after what I originally said in deprecation of mere generalisations, based upon no observations, and from which anybody can argue anything.

Dr. St. George Elliott: I agree with Mr. C. Tomes most fully that it is useless to speak on a subject unless we have something of value to advance; and let me say to the young men of this Society, that if they would work at home and do something for the advancement of our great science, at the end of the year we should have some materials to base a positive theory upon. For instance, with regard to the condition of acidity in the mouth, or the opposite, if only one in ten would test one in twenty patients with litmus paper, he would be able to form some general ideas as to whether acidity is really common or not, in connection with caries. And if every one of us—and I believe there are a large number of members of the Society—would take every case that comes to him for one year, and would test the condition of acidity of the mouth, even if he only uses litmus paper,—it is not at all a difficult operation,—and tests every cavity to find if they are uniformly acid, we might suddenly discover that a large proportion of these cavities are alkaline. Of course we do not expect any such thing, but sometimes we meet with just the things we do not expect.

The theory that micro-organisms are the cause of decay is a very old one. From the dawn of the human family to

the present time the common people looked to "worms" as the cause of toothache, probably because toothache, as a rule, is of an intermittent character, generally more or less violent, giving the impression that some animal is biting. So common is this at the present day in partially civilised countries that dentists recognise it as a fact that not only micro-organisms exist, but something very much larger, which is very easily defined—something that they can pick out of the cavity of the tooth, and show it to the patient. The Chinese dentists are exceedingly expert in this kind of thing. When you visit a Chinese dentist (he has no office or surgery, but you generally find him in the street under an umbrella, or by the side of a fruit stall in the market-place), and you present yourself with your aching tooth, he will tell you at once that the cause is a little "wiggler"—a little animal biting the nerve in the interior of the tooth. You doubt it naturally, supposing you are a foreigner, because you have been better educated. He immediately takes his instrument, his spatula, puts it in your mouth, and with his pair of tweezers pulls out a little animal, a worm, and shows it to you in order that you may examine it yourself; if you like he will take out two or three more. When you are satisfied as to the cause of the toothache he will, with the help of a hammer and a piece of wood, soon extract the tooth, and relieve you from further trouble. It is done in this way. On the side of the spatula there is a shallow hole, the spatula being a narrow piece of wood; the hole is covered with a thin piece of paper, and in the hole there are a number of these little artificial worms. On introducing the spatula into the mouth, the paper becomes moistened and is readily torn with the finger, and these little creatures are picked out and shown. Now it is a strange fact that this explanation is recognised throughout the whole of the Eastern world, not only in China, but you find the same thing in Thibet, Northern Siam, North Western India, and even in South America, where an entirely different condition of affairs has existed for centuries.

I should like to say, with regard to Dr. Miller, that I saw

a very large number of his specimens, probably over a thousand, and they certainly appeared to bear out all that he had stated with regard to them; that is to say, as a rule his specimens first commence with leptothrix: this breaks up into bacilli, which are a little shorter, and then into the micrococci. These are the three forms which he invariably finds. Now you must do him the justice to think that he is honest. He had no hobby to bring forward; he simply wanted to demonstrate the truth. Now, if in over a thousand experiments that was the result, you certainly ought to give him credit for it. I would like to say that, upon a survey of the different theories of caries, it occurs to me that it is utterly impossible for us to accept any one. We have had professors, and lecturers, and speakers upon this subject throughout the world: all have adopted different theories; all have brought forward particular hobbies of their own, and it is only by a certain amount of coalescing of theories, and combining of two or more together, that we can meet the case. For example, the chemical theory is the most popular one at the present day, and it certainly accounts for a great deal. But if chemical action is invariably the cause of decay, why does not it exist always in those places where you have the greatest amount of acid—between the teeth? Why does decay occur at any point in the mouth or any part of the teeth? Of course it is readily answered: there must co-exist with this chemical condition a condition of formation of the teeth originally. There must be a defect in the structure of the tooth at the point which is acted upon by the acid, and I think this is now generally recognised by certainly all prominent dentists.

Mr. Henry Moon: I am afraid I have only general impressions to speak to, but those general impressions would lead me to imagine that perhaps one active agent in starting decay has been omitted from our discussion, and that is the mutual pressure of the teeth. Where teeth are closely packed together, the attrition which they exercise upon each other may possibly disarrange the enamel sufficiently to let in the other factors of decay. I say this because if you examine old

skulls and old teeth, you will find the sides of teeth which have been closely in contact very often present polished facets; and if in those strong teeth we get polished facets, I think in the weak modern teeth we are likely to get sufficient disarrangement of the enamel to let in the factors of decay. It is generally admitted, I believe, that modern teeth are exceedingly weak as compared with the teeth of more primitive times. In fact, it seems to me that it would be as unreasonable to expect the modern fragile tooth to resist the same destructive agencies as the strong tooth of old did, as it would be to expect the houses of the jerry builder of the day to stand wind and weather in the same way as old masonry does. I may mention one case which I remember, in which acid, as I imagine, was the prime factor; and I think we shall find in our practice, and in our observations, that particular cases will crop up which have to be investigated separately—they will have different surroundings from the generality of our cases. In that particular case a patient came to me whose diet for years had consisted almost entirely, as he told me (and he was a clergyman), of cheese and bitter ale. I had to put in lower teeth for him, and I simply cut his teeth off with a knife, instead of having to use a saw, or to nip the teeth off. That was a case of decalcification; but whether this was due to an excessive degree of acidity in the mouth, which I think most probable, I cannot be sure, as I unfortunately did not test. Another point that I think presents a good field for observation to any man who has the requisite knowledge, and the time, is that of the saliva derived from the different glands. I think that we must all have observed the extreme amount of decay which one sometimes sees in the case of patients who have an immense flow of watery saliva. Then in other cases we all have seen how *viscid* saliva is accompanied by a very exceptional amount of decay. It appears also to me that our predecessors in dental surgery had only to deal with reasonable decay, decay that occurred in the natural fissures of the teeth; but we in the present day have to contend with interstitial decay. It is a constant experience that young people come to you who, with

the exception of the lower incisors, have nearly every tooth in their heads decayed wherever they touch their neighbours. This will bear out the theory, or rather the fact, of the greater weakness of modern teeth, and also, probably, of some unhealthy condition of the oral fluids, which perhaps before were not present. I think the question of the really great comparative immunity of the front lower teeth is well worthy of consideration. My own experience is that the lower front incisors and canines escape decay remarkably as compared with other teeth, until we put in a lower artificial denture, and the theory—it is simply a theory—is that possibly those teeth have escaped because they have received a constant alkaline wash from the saliva poured out from the sub-lingual glands. It may be that artificial denture acts injuriously by preventing this, or it may cause that amount of attrition which will so far injure the enamel as to let in the factors of decay. I fully concur in the remarks reported in the last number of the "Transactions" as to the desirability of great attention being paid to the diet of children in infancy, and in their earlier years, and also to the diet of the pregnant mother. I would go a step further back even, and look to the breed of the race. I do not see that it is altogether the duty of medical men to leave this great question of national importance to be impressed upon the public through the columns of a comic paper. I daresay you all remember the picture of Du Maurier's in *Punch*, in which a young lord, of rather bad physique, addresses a bull in his father's field and says, "What a fine fellow you are!" and the bull replies, "Ah, my lord, if your ancestors had taken as much trouble with your breeding as they did with mine, we should have a very different result."

Mr. S. J. Hutchinson: It is difficult for those speakers who follow Mr. C. Tomes and Dr. St. George Elliott to venture upon their feet at all, but I have been bold enough to do so because my name appeared on the back of the last number of the "Transactions." If it had not been there I do not think I should have mustered up courage to come forward. I think even Mr. Tomes, with his critical manner, has made a little

mistake in departing from the question which is before us. We are not asked to theorise ourselves at all on this question, but we are simply asked, "Do the incontrovertible facts which we now possess, as to its etiology and pathology, fully account for the phenomena of dental caries?" We are called upon to look to what has been already written and done, in the way of investigating the cause of dental caries, to see whether those facts do sufficiently account for dental caries. Now I venture to take my stand here, and I hope I shall be supported by the majority of the members present, although I do not suppose it will be put to the vote, and this I say most distinctly, that the "incontrovertible facts" which we have are not all of them incontrovertible, and in the next place, I say that the view taken by Mr. Coleman at the end of the discussion at the February meeting is one, I think, which will be more universally received than that put forward by Mr. Sewill. I would only call attention to his own address to show you how strong the doubt is in his own mind—I do not mean in his literary mind, but in his mental mind—as to what dental caries really is. He says, "Though the treatment of dental caries which has been empirically followed has certainly been fairly successful, still there is no knowing but that it might be modified with advantage *could we be certain of the true nature of the disease.*" Mr. Sewill himself is, therefore, not certain of the true nature of the disease, and, therefore, the incontrovertible facts that we know so far are not incontrovertible, neither do they fully explain dental caries, even to the critical mind of our friend Mr. Sewill.

Mr. Sewill: I did not say that.

Mr. Hutchinson: I beg your pardon; I am reading from the February number of the "Transactions." If it is not correct I am sorry it was not corrected before it appeared before the Society. It further goes on to say, "But although vitality might modify the process to some extent, causing pathological changes, it could not protect the tissues from the action of physical laws." Mr. Sewill admits here that vitality might modify the process to some extent. Now the standpoint I

wish to take to-night is that dental caries is not entirely due to external causes, but that there is some process of vitality—I will use that word as Mr. Sewill does so, but I should myself prefer to use the term organic process—that is to say, that it is due to the presence of a living power, which I will not venture to explain, and not *entirely* due to chemical and external causes. I think that that is the view taken by the majority of those present who are in possession of the facts—I will not say the "incontrovertible" ones—as yet known about dental caries. I want, just in pursuance of this plan of mine, to call attention to one or two facts which support this view—facts which are patent to the world; and I would ask Mr. Sewill whether he does not think that there must be some action going on in the tooth substances through the organic soft fibres of the dentine. He compares dentine to another non-vascular structure, the cornea of the eye, in which it is known there are no obvious vascular passages beyond those which form a sort of ring round the periphery of the cornea. But Mr. Sewill admits that inflammation can occur in the cornea, where there are no blood corpuscles visible; neither are there corpuscles found in the dentinal tubules, on account of their minute diameter; but the structure of the dentinal tubule is such that some process must go on in it, just as there is a process going on in the intercellular tissue of the cornea. I am not advancing any theory of my own, but simply asking whether we must not take this into some consideration. Mr. Sewill, in his little book, I think—I should not like to misquote him again—says that it is not advisable to use very hard stoppings in six-year-old molars, because as the patient grows in years the tooth becomes consolidated. If Mr. Sewill does not say it I know it occurs in one of our valuable text-books, and I think our experience will bear us out in the fact that it is not advisable to put hard fillings into six-year-old molars, and that we do find that as life advances the tissue of the tooth does get harder, and this must be due to some "vital" process. Again, it is well known that in many cases where dental caries attacks the teeth, a secondary deposit of dentine takes place opposite the point of commencing decay. How does the pulp know

that there is caries going on at the periphery of its dentinal tubules? Must not there be some circulating influences going on through the soft fibres of the dentine which are able to communicate to the periphery of the pulp the action which is going on at the periphery of the dentine? I am only stating all this simply to oppose the view that external influences are entirely the cause of dental caries. In conclusion, I want to read a very short extract from the paper by Dr. Norman Kingsley, of New York, which was read at the International Congress. I simply read this endorsing it as my view, and as the view, I believe, of the majority of the dental profession, and certainly I hope of the members present to-night.

"The teeth require as much constant nutrition as the muscles, the bones, or any other organs or tissues of the system. Teeth decay, primarily, because the nutrition of their organic structures being withdrawn, retrograde metamorphosis ensues; and secondarily, because the agencies born of diverted, improper, or inadequate nutrition are capable of producing their chemical solution. Caries is simply solution, or disorganisation, of tooth constituents by agents which are always external, but which would be quite inert under other constitutional conditions. The vitality of well-organised tooth structure in a healthy body is quite sufficient to counteract the effects of any active external agents which might be temporarily present; but when nutrition is insufficient or diverted, the resisting power of its vitality inadequate, and destructive agents present, the teeth will yield at their weakest points, and caries will result."

I had intended to allude to Mr. Milles's investigations, and also to the caries of dead teeth, but I have taken so much time, and there are so many other members who wish to speak, that I will not say any more.

Mr. Charters White: The subject under discussion to-night is one of great interest to us all, because it constitutes, as it were, the basis of most of our dental practice. We all know that if there were no decayed teeth there would be no stopping, and if there were no decayed teeth there would be no supplying of artificial teeth, and it is therefore the principal disease which we are called upon to treat. But really I do not think I can add anything to the opinions that have been

expressed so ably by the gentlemen who have preceded me. I have a strong feeling myself that caries is mainly due to chemical action, for various reasons. You generally find that dental caries manifests itself in those parts of the mouth where a lodgment of any kind can be found—as, for instance, in the case of those interstitial cavities which come before us so often, and in pits and fissures on the grinding surfaces of the molars. You very seldom find a decay originating in the front of an upper central tooth. You never find it occupying the polished surface, but you nearly always find it by the side of the teeth. You will find often that it originates between teeth very close together, which have been exercising a mutual pressure and crushing each other down. Again, I have a patient who had magnificent teeth, an entire set, but they were very close to each other, and after an attack of rheumatic fever there were interstitial cavities between all the teeth, the result of mutual pressure and acid medicine. Then another thing leads me to conclude that chemical action has a large share in the production of dental caries, and that is, if we have a patient who has not very cleanly habits, and who wears an artificial denture from one year's end to another without taking it out—if you take that plate out of the mouth you will find that the pattern of the plate is mapped out with superficial caries and decalcification of the teeth all round. Caries is therefore often set down to the wearing of these artificial teeth, whereas it is in consequence of the chemical action set up. I am always very careful to impress upon patients the necessity of keeping the insides of their gold plates perfectly clean and polished, and then no disease will arise, because I feel it is entirely from that cause. I thought it might be interesting to the members if I put a few photographs in my pocket which have been taken from microscopical sections, and which will show the liability of those teeth where there are fissures existing to dental caries, above those which are more soundly built. You will see in this photograph, Mr. President, a longitudinal section through the top of a decayed tooth, with a fissure almost through the enamel. That would form a lodgment for food, and acidification would take place,

and extend the decay. Already you will find that in the dentinal tubuli there is a consolidation taking place, and the transparency is shown by the light passing through. In the other specimen there is an abnormal fissure at the top of the tooth, and the irritation has been so great that numbers of the dentinal tubuli have been filled up, and a mass of secondary dentine formed in the adjoining pulp cavity. Then, again, if you examine the other photograph, showing globular dentine, you can readily imagine that if once acid should gain access to the interstices between these globules, rapid decay would set up; but I have often noticed in these cases that the ridges and pits have been filled up by tartar, and I suppose in that way the acid has been checked, or else there would be more wholesale destruction than we usually find. All these things point to the chemical origin of caries. I do not say that the vital causes are excluded altogether, because I think that vital action bears a large share in the dental economy. As has been pointed out by Mr. Hutchinson, you will often find that in the commencement of caries there is a consolidated zone of the dentinal tubuli, which is a little way in advance of the caries, and that evidently must be due to some vital action. These tubuli are consolidated with a view of blocking out the disease—erecting a barrier to prevent further irritation to the nerve. Then, again, we know that if there is an invasion of caries approaching the pulp cavity, we often find a nodule of dentine formed inside the pulp cavity, which acts, to a very large extent, as a patch to keep out the invading enemy. That shows that vital action has a large share, not indeed in the production of caries, but in attempting to oppose its progress. Then, again, vital action may be often seen in the symmetrical arrangement of decay. I have one patient now in my mind where the central incisors at the front on each side are marked by symmetrical spots, something similar to those white spots you get on your nail. There was evidently some symmetrical action going on there during the development of the tooth, and if this symmetrical action can take place in the formation of the tooth, why should it not equally take place in its destruction? Therefore, while I hold that chemical action

is to a large extent answerable for the production of dental caries, I think we must not at the same time exclude vital action from having some share in it as well; but these are things which remain to be further worked out.

Mr. A. Coleman: I will only detain the Society a short time, after having trespassed so much at the last meeting. Mr. Sewill, in opening this subject, laid immense stress on the fact that "caries was not a disease." Afterwards he says that "caries is by far the most important of all dental diseases," and I think we may come to the conclusion that it is a disease, and that it has a pathology. Mr. Milles has pointed out that the view which is gaining ground is that not only the diseases he has mentioned, but many others are the result of micro-organisms; and if dental caries be, as I believe he and Mr. Underwood assert, chiefly due to these, it must be likewise a disease. There is another point which I noticed on reading Mr. Sewill's speech, but which I overlooked when I was discussing the subject at the time, and that is, that one of the "incontrovertible facts"—and I am very glad that Mr. Hutchinson has alluded to this—is, "if caries commenced in these tissues as a true disease, we should certainly expect to find at an early stage some vascular disturbance of the pulp; but this never occurred."

Mr. Sewill: May I ask where that is called an incontrovertible fact?

Mr. Coleman: "Do the incontrovertible facts which we now possess as to its etiology and pathology fully account for the phenomena of dental caries?" It is stated that this "never occurs." Surely that is put forward as an "incontrovertible fact." The only matter to which I would further allude in connection with this is one I forgot to mention in my former remarks. I did allude to the circumstance that we frequently found superficial caries to exist on the masticating surfaces of the molars, and when the thin enamel was broken away, the surfaces become very hard and very highly polished—more so, I believe, than we could calculate would occur from the ordinary attrition of mastication, and the rubbing of the teeth together. I think I may say that this will never be

found to occur in dead teeth. I candidly admit that such teeth may undergo caries at their anterior or posterior surfaces, and then become dead. Then there is this other fact. Do not we find in cases of caries, especially those which we are apt to call the rapid or acute form, that the exposed dentine becomes hypersensitive? There are certain operations that have been performed in which we may drill into the healthy dentine. There was the operation of Dr. Bing, in which artificial teeth were secured in place by means of gold pins inserted into healthy teeth. I have seen a few patients upon whom that operation had been performed, and I asked them if it was painful, and they said, No, it was quite tolerable. We know that in many cases of dental caries the surrounding dentine becomes very sensitive, and I think that is some evidence that a pathological change has taken place, due, no doubt, to what we all admit to be the primary cause of dental caries—external agencies, acids, and the fermentive processes. But these acids and fermentive processes are continually acting. The teeth are constantly exposed to them in greater or less degree. With regard to those fissures where we sometimes find decay to take place, those fissures may remain through life, and yet decay not take place in them. Therefore, I think we must maintain that in the cases where decay does occur there is a failure; there is a want of that which arrests, and that which counteracts, those principles which are continually and ever acting upon the teeth.

Mr. Stocken: Mr. President,—I did not contemplate making any observations upon this subject, and therefore the few remarks I am about to make will be very short. I think that we must in this matter look to the original cause, and that is in the parent. If the tooth is constitutionally bad, then it is liable, more than under other circumstances, to be acted upon by the secretions of the mouth. I think that chemical action has rather more to do with caries than vital action; for I have seen in my own practice constantly that when relief has been given to crowding, the teeth on that side of the mouth have remained perfectly good for many years, whereas on the other side, where the crowding has remained,

the decay has gone on in almost all of them. I can recall at this time one case that most clearly exemplified this. It was the case of a young lady who came to have her teeth regulated. I came to the conclusion it was necessary to give relief on both sides. I operated on one side, and an appointment was made for her to come again and have the other side operated upon. She did not come, and she grew up to womanhood, and it was not until some years after the operation that I saw her again. On the side where I had operated there was not a single carious tooth, whilst on the side not operated upon, almost every tooth was decayed, from the canine backwards. As a practical application of my opinion as regards the chemical action, I have for some year or two now suggested to my patients that they should use an alkaline powder for cleansing their artificial teeth—a powder containing simply chalk and the neutral carbonate of soda. I find the advantage of it is this, that the neutral carbonate of soda renders fluid the mucus which generally attaches itself to artificial dentures, and which patients are unable by the aid of soap or simple brushing to remove; and if not thoroughly removed it will undergo change and become acid, and the result is a dissolving of the phosphate of lime. I have found that since my patients have used this prepared chalk and neutral carbonate of soda there has been less mischief resulting, and I think you cannot have a better proof than this, that chemical action is a most important factor in the destruction of the teeth.

Mr. Henry Moon: I think that most of the arguments used, especially perhaps those used by Mr. Charters White, in favour of the acid theory in opposition to the action of micro-organisms, will apply equally in favour of the micro-organisms; but perhaps the facts mentioned by the last speaker point rather more to acid as being one of the prime factors, and some facts that I have myself noticed I think point also in the same direction. We have all seen a zone of decalcification of white, chalky enamel running round wisdom teeth. My own belief is that that results from the difficult eruption of the wisdom tooth, the tooth being held in contact

with the edge of an irritated and inflamed gum at that point. The same thing is said to happen if silk, used in regulating teeth, has been kept for any length of time in contact with the tooth. As to the decay occurring in weak modern teeth in the natural fissures, in a much greater extent than it occurred in teeth of stronger structure, that is accounted for in this way, that those natural fissures are simply to be regarded as the points of junction of the first formed caps of dentine and enamel, and those points of junction are almost invariably at the present time faulty.

Dr. George Field: If the presentation of absolute facts debars one from speaking on the subject, I think I should be debarred, not having made any long-continued series of experiments. But from simple observation of the mouth I should feel disposed to accept the position taken by Dr. Abbott, of New York—the combination of the two theories, the chemical as well as the micro-organic. I would simply propose, instead of making any statements, to ask one or two questions. Why is it that the points at which we find decay are those, not where the brush will reach, not where the facets are made upon the teeth, not in the lower incisors, which are constantly washed by a free flow of saliva, but always just at the margin of the gum, usually a diseased gum, and just below these facets of the teeth, and in the fissures of the teeth? In the fissures the decay is arrested if there chances to be a deposit of tartar, and in the lower incisors I think I have never found it present except where there was an inflamed state of the gums. I account for that by there being a natural tendency to, as it were, draw in, or, in other words, to suck through the teeth, forcing the flow of saliva between them. That is done unconsciously. Perhaps I may mention that in the Scotch we find the very best tooth development and the least decay. That has been my experience here in London with the adults; but the children are not so good as the adults. That shows, as it seems to me, that there is an organic change in consequence of altered habits of life, food, nutrition, and so forth. It would also appear to support the theory of the combined action of the two agents: first, that

enamel is acted upon chemically, and afterwards we find the presence of micro-organisms. I simply put these as questions, rather than as a statement of facts, as I should not presume to present any such things as facts.

Mr. Sewill, in reply, said: Mr. President,—I shall try to make my remarks as general as possible, and I will be as brief as I can. First of all I would say that my remarks are very well represented indeed in the "Transactions." The mistakes that have been pointed out are unimportant. The only thing I should wish to correct is an error that Mr. Coleman fell into. At the outset of his remarks he ascribed to me that I expressed an opinion that because caries was excited by external causes, therefore it could not be a disease.

The pith and point of my remarks was this—that caries is due to external agents, that the dental tissues are passive under those agents, that there is no pathological action, and therefore that caries, in the strict sense of the word, is not a disease. I could not possibly have uttered anything so absurd as that because a disease is excited by external causes therefore it has no pathology. If I had said that I should have ignored numerous diseases which are undoubtedly due to external agencies. My whole speech would be meaningless unless that point were clear.

Mr. Hutchinson: How ought this sentence to be read? because it is very important to know what it ought to be: "Could we be certain of the true nature of disease." I think that is a very important point.

Mr. Sewill: In my opening remarks I dwelt on the importance of the discussion, and I remarked that our treatment had been empirical hitherto,—and that is very evident from the discussion to-night,—and that we could not tell, if we were agreed as to the actual nature of the disease, what modification we should be led to in our treatment. I maintained that caries was due to external agents, and I held that the tissues were perfectly passive under those external agents; and I maintained that the incontrovertible facts which we possess prove that. The discussion to-night has gone off into details

as to the exact changes which take place in the tissues, and which, in my statement, I said were not of extreme importance, but that probably more light will hereafter be thrown on the more minute changes which take place in the tissues. The point of importance is that we should not subscribe to the statements made in this room that the teeth act and react from constitutional causes, and that they are influenced by disease in the same manner as vascular tissues. It is quite certain that pathology must be based on anatomy and physiology, and if any apparent fact comes forward which is opposed to the established facts of anatomy and physiology that fact must be put on one side, and cannot be accepted. I maintain that our knowledge of the structure of dentine and enamel, and our knowledge of anatomy and physiology, justify us in stating that it is impossible that those tissues can be the seat of anything which can be compared to pathological action, or vascular action, in any other tissues of the body. Mr. Coleman's speech has been mostly addressed to controvert my view. I am sorry he has been so brief, and I trust that next session he will come forward with a paper from the opposite point of view to mine. It will be very valuable, because there is no one more able, or apparently more full of belief in this point of view, than he is. If he comes forward next session, and kindly explains to us how it is possible for pathological phenomena to occur, and to be reconcilable with what we know of the anatomy and physiology of these tissues, then I shall be almost inclined to subscribe to the truth of the vital theory of caries. Mr. Coleman proceeded to adopt Dr. Abbott's view. Dr. Abbott seems to imagine—and I speak with the greatest respect of Dr. Abbott, because any one who pursues scientific work deserves thanks and gratitude—that he sees in carious dentine the phenomena presented in inflammation of vascular structures. So far as I can understand his writings and microscopical drawings, which are not at all clear, he tries to depict corpuscles and inflammatory products in the dentine, such as we find in vascular tissues during inflammation. If Mr. Coleman will explain how such a change is possible in the dentine, I shall subscribe to his theory.

Dentine consists of a calcified matrix permeated by tubes not more than $\frac{1}{4500}$th of an inch in diameter, which are filled by fibrillæ, and if he will explain how inflammatory corpuscles pass into the substance of dentine I shall be glad. He may, perhaps, allege that they are produced in the tissue, out of the elements of the dentine; I should like to have that explained. I maintain this, that when a statement like this is put forward, which is utterly opposed to our physiological knowledge, we are justified in rejecting it on *à priori* grounds. Then Mr. Coleman says that he has tested the saliva in various cases, and has found it not acid. We do not depend on the saliva alone for the acid which originates caries, and even if we fail to discover acid, it would certainly only prove that our observation has not been complete. It would certainly never prove that a pathological action had originated in the enamel. Can we imagine that this dense, almost homogeneous structure, as hard as flint, and as compact, can be the seat of pathological action, or the seat of nutritive changes? If it be the seat of such changes, how are they brought about? If we go back to the formation of the enamel we find that this pulp begins to calcify after the dentinal pulp. It proceeds outwards from the surface of the dentine, the dentine having been previously calcified from the periphery towards the centre. When the enamel is calcified the vessels disappear and the enamel is covered with Nasmyth's membrane, which is derived from the same source as the cement. This calcareous structure, enamel, super-imposed on the dentine, not only gets, by some mysterious means, nutrition through the dentinal tubes, but the source of its nutrition is thus changed. It must first come from without, and then the dental pulp takes on the office, and passes its vital influence—the nature of which I should like explained—through the dentine, and sets up pathological changes in isolated spots on the enamel. I say, on physiological grounds, this theory is impossible, and we must reject it. This observation leads me to the same fact with regard to teeth decaying in course of some diseases. In such cases we must look for local causes, and if we do not find those causes, we certainly cannot accept such an hypothesis

as that the enamel at periods can become the seat of pathological action.

Mr. Coleman asks why the teeth do not decay over the whole surface. The reason is pointed out by Wedl—that even in teeth of apparently sound structure you find microscopical fissures, if not larger ones, in the enamel. These are sufficiently large to hold decomposing products, and it is only a question of time, and a question of the secretions of the mouth, to get solution. But even if we cannot find an explanation of decay in conditions of the secretions—and I believe we have found it—we must abandon the proposition which Mr. Coleman seems to support. Mr. Coleman also supports his argument by the fact that we have true caries in cementum. On *à priori* grounds I should argue that we might certainly have caries and inflammation in cementum, under favourable conditions. Cementum is bone, and therefore it is not astonishing at all. On similar grounds that ulceration and caries, as it occurs in bone, is possible in cementum, I think it can be demonstrated that this process is impossible in dentine.

With regard to the remarks as to the pulp. The pulp is a vascular and cellular structure which is subject to all the phenomena of inflammation. On the approach of decay, or the entrance of bacteria, which are proved to pass through the tubes when decay approaches, you have the phenomenon of inflammation in the pulp; but surely that is quite outside the question. It is an episode in the progress of caries. By caries we mean disintegration of enamel and dentine, and I think that the evidence we have is sufficient, backed by physiology and anatomy, to prove that caries consists of disintegration of enamel and dentine, due to external causes, and that enamel and dentine are passive. Mr. Milles's remarks are very valuable indeed, and especially for the confirmation which his and Mr. Underwood's investigations give to the observations that Wedl positively puts forth, and in which he is supported by Tomes, namely, that you get caries in dead teeth, and in hippopotamus ivory, which is practically identical with caries in the human teeth. That one fact alone is sufficient to establish my case.

Mr. Moon's remarks go to explain some cases which seem doubtful at first. If teeth are rubbed together, and they rub down sufficient of the enamel to leave a rough surface, caries may originate. Then Mr. Hutchinson thinks that I stated that one ought not to fill the teeth of young children with hard fillings because the dentine becomes hardened. I never made any such statement, either in my writings or speeches. I will not enter into the subject now, but if inflammation occurs in the pulp of young children's teeth it must be explained on other grounds. Then Mr. Hutchinson thinks that because the pulp calcifies that shows vital action in the enamel and dentine. I should like to have some further explanation of how that is. Of course dentine conducts heat and cold, and it conducts organisms, and you get irritation with changes of temperature. All is explicable without imagining that the dentine is showing pathological action. Dr. Kingsley's remarks, with regard to retrograde metamorphosis, fall within the category of "impressions" spoken of by Mr. Charles Tomes. I do not think they need any answer at all. Mr. Coleman dwells upon the grinding down of the teeth and the spontaneous cure of caries. Some of these individual cases may be rather puzzling, but because they are a little puzzling we need not fly to an hypothesis which cannot be believed to explain them. Very often in these cases the surface of the teeth is exceedingly badly made—the defects are structural—a point I dwelt upon in my opening speech. Few people's teeth are free from structural defects, and some mouths are full of teeth which are very ill-constructed from end to end, and in those cases you get a grinding down of the ill-made surface until, better made tissues being reached, this becomes polished by mastication. I think that is a simple explanation which is quite as good as imagining that some vital process is going on. Mr. Charters White rather surprised me by alluding to the "zone of calcification" as a vital phenomenon. I thought that was entirely given up. I think the only one who believes that "zone of calcification" is a vital phenomenon is Dr. Magitôt, but his work is many years old, and so many persons have proved

that the same thing is found in teeth decalcified by acid out of the mouth, and in dead teeth in the mouth, that I thought the idea that this zone means solidification of the tubules was quite abandoned: it means slow solution of the dentine by acid. In conclusion, I may say I trust that this discussion will be revived in another form next session, because as long as the question remains unsettled, it affords intellectual amusement of the best kind to discuss such a subject. I am much obliged to you for the patience with which my observations have been listened to.

The PRESIDENT said that as the usual time for adjourning the meeting was already past, he would only briefly thank Mr. Coffin and the other contributors of the evening, in the name of the Society, for their communications, and wish the members generally a pleasant vacation. The meetings would be resumed in November, when he hoped that Mr. Power would read a paper on "The Influence of Dental Irritation and Dental Disease on Affections of the Eye."

(The meeting then terminated.)

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